INSTITUTES

OF

BOTANY;

CONTAINING

Accurate, compleat and eaſy Deſcriptions of all the known

GENERA OF PLANTS:

Tranſlated from the Latin of the celebrated

CHARLES VON LINNÉ,

Profeſſor of Medicine and Botany in the Univerſity of Upſal; Firſt Phyſician to the King of Sweden, Knight of the Polar Star, and Member of moſt of the Learned Societies in Europe.

To which are prefixed,

I. A View of the ancient and preſent State of Botany.

II. A Synopſis, exhibiting the eſſential or ſtriking Characters which ſerve to diſcriminate Genera of the ſame Claſs and Order; as likewiſe the ſecondary Characters of each Genus, or thoſe derived from the Port, Habit or general Appearance of the Plants which compoſe it.

By COLIN MILNE,

Reader on Botany in London, Author of the BOTANICAL DICTIONARY.

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M,DCC,LXXI.

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Jos: Banks

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ADVERTISEMENT.

A Tranſlation of the GENERA PLANTARUM has not hitherto been attempted in any language, notwithſtanding the great reputation of its ingenious author, the diſtinguiſhed taſte of the preſent age for improving and diffuſing natural knowledge, the excellence of the work itſelf; and, above all, its indiſpenſible uſe to every botanical ſtudent. The characters of claſſes and orders, the primary diviſions in every method, are generally conſtituted from a ſingle circumſtance; ſo that genera, without the aſſiſtance of accurate and compleat deſcriptions, may be eaſily referred to their proper place in the arrangement. But in detecting the genera of plants, or referring any particular plant to its genus or aſſemblage, ſuch a complication of circumſtances muſt neceſſarily paſs under review, ariſing from a compariſon of all the parts and modifications of the flower and fruit of the plant in queſtion, with thoſe of the genera of the ſame claſs and order, that it is impoſſible, without the aid of deſcriptions, and thoſe full and accurate,

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to advance a ſingle ſtep with certainty and preciſion. To the learned and claſſical reader, the GENERA PLANTARUM, in its original form, ſerves every purpoſe of information for which it was intended; but to the illiterate and unclaſſical, who, by the way, conſtitute the bulk of thoſe whom inclination or chance have directed to the ſtudy of plants, that form proves an inſurmountable obſtacle. It deſerves likewiſe to be mentioned, that many Ladies who would apply with indefatigable attention to the ſcience of plants, are denied the pleaſure reſulting from ſuch a ſtudy, for want of proper aſſiſtance in a language which they underſtand.

FOR theſe reaſons, it appeared highly probable that an Engliſh tranſlation of the GENERA would prove not altogether unacceptable to the public. To render it, in ſome meaſure, more compleat, the Tranſlator has preſented the reader with a Prefatory *View of the ancient and preſent State of Botany*, including a particular analyſis and illuſtration of every plan of arrangement which has appeared ſince the origin of the ſcience. The utility of ſuch a diſcuſſion is too obvious to be inſiſted on. In characteriſing the ſeveral authors which paſs under review, the Tranſlator is not conſcious of having indulged malevolence, or diſcovered want of candour. The merits and defects of each method

are,

are, to the beſt of his judgment, impartially ſtated; their comparative excellence it is the province of the intelligent botaniſt to eſtimate and determine. He hopes it will not be imputed to him as a fault, that, in a few controverted points, he has ventured to differ in opinion from ſome of the moſt diſtinguiſhed names in Botany. Such diſſent has been always accompanied with reaſons which, to him, appeared ſatisfactory: if they appear otherwiſe to the reader, he is at freedom to think for himſelf, and reject the opinions, ſo lamely defended, as heretical and erroneous. Throughout the work, he has endeavoured to expreſs himſelf with perſpicuity and preciſion; and, in enumerating the characters of the genera, has carefully avoided that affected conciſeneſs which has lately crept into botanical deſcription, and is totally repugnant to the genius of our language.

Upon the whole, the Tranſlator flatters himſelf that his hopes of ſucceſs are by no means equivocal. The attempt ſurely needs no apology: the execution muſt ſpeak for itſelf. The Tranſlator has devoted his whole time and attention to the ſtudy of plants. In that department he deſires to be uſeful to the Public: and if, in the courſe of his repeated endeavours, he ſhall be happy enough to remove that air of myſtery, and diſpel thoſe clouds of obſcurity in which he found

his

his favourite ſcience involved, he doubts not that the Public, enemies to the monopolizers of knowledge, and ever diſpoſed to encourage laudable purſuits, will candidly acknowledge that he has obtained his wiſh.

The Tranſlator cannot conclude without offering his grateful acknowledgments to all the friends and well-wiſhers of this work, and particularly to John Hyde, Eſq; Governor of the London Aſſurance, and Fellow of the Royal Society; by whoſe generous aſſiſtance he has been enabled to carry it on. With pleaſure could he expatiate on that univerſal benevolence, that unbounded deſire of doing good, which characteriſe every action of this beſt of men, the value of whoſe favours is ſo greatly enhanced by the exalted motives from which they proceed, and the truly engaging manner in which they are conferred. But he knows the extreme delicacy of the ſubject, and ſhall therefore forbear: happy if he has not incurred his diſpleaſure by giving this ſmall, though heart-felt, teſtimony of his goodneſs.

A VIEW

A

VIEW

OF THE

ANCIENT AND PRESENT STATE

OF

BOTANY.

Including a particular Illuſtration of every Plan of Arrangement which has appeared ſince the Origin of the Science.

Filum Ariadneum Botanices eſt SYSTEMA, ſine quo Chaos eſt Res Herbaria.
Lin. Phil. Botan. P. 98.

Quid unquam Botanica, vel quis Botanicus abſque Methodo?
Lin. Claſſes Plant. in Præfatione.

A VIEW OF THE ANCIENT and PRESENT STATE OF BOTANY.

SECTION I.

Characteriſtical Diſtinctions of the Three Kingdoms of Nature.

ALL natural bodies conſidered *in cumulo* agree invariably in certain qualities, hence ſtiled the Univerſal Qualities of Matter. Theſe are Extenſion, Figure, Mobility, Diviſibility and *Vis inertiæ*. Every body is extended, has figure, may be moved, is diviſible into parts, and is ſluggiſh or inactive. The univerſal properties of matter, juſt mentioned, are the objects of Natural Philoſophy: but being poſſeſſed indiſcriminately by all bodies, become neglected in Deſcriptive or Natural Hiſtory, where the ſubjects are arranged, not from circumſtances of univerſal ſimilitude, but the contrary.

THE quieſcent forms of bodies, and their co-exiſting qualities, about which Deſcriptive Hiſtory is converſant, ſufficiently diſtinguiſh it from Narrative Hiſtory, whoſe object is active nature, the operations of which are exceedingly diverſified.

MAN, with reſpect to the anatomy of his body, is, in ſome meaſure, a ſubject of deſcription. Such variety, however, does he exhibit in point of character, talents, capacity, ingenuity and force, that each individual of the ſame age is ſufficiently diſtinguiſhed from every other; nay, whole races and ages of men are diverſified in like manner: ſo that human affairs are much more properly the ſubject of Narrative than Deſcriptive Hiſtory. Thoſe only are, with propriety, to be ſtiled ſubjects of the latter, where the deſcription of a ſingle individual exhauſts the deſcription of the ſpecies to which ſuch individual belongs. As individuals conſtitute a ſpecies, ſo a number of different ſpecies agreeing invariably in certain circumſtances, conſtitutes a genus or kind; and genera, having reſemblances of the like nature, form higher diviſions or claſſes. Thus the principal object in Deſcriptive Hiſtory is to form theſe diviſions of the ſubjects to be deſcribed; and, for that purpoſe, to enquire minutely into their nature, their different parts, and their reſemblances; as it is upon the circumſtances of ſimilitude and contraſt that the Method or Arrangement in Deſcriptive Hiſtory depends. This method of combining different ſubjects under a point of reſemblance, is an act which the mind is continually exerting in the acquiſition of knowledge. No fact or particular is left ſolitary or detached. The mind naturally looks for its help-mate; and, by regarding many different ſubjects under one point of view, facilitates its progreſs in each attainment. We are always led to generalize. We do ſo in Deſcriptive Hiſtory; we comprize ſeveral ſpecies under one genus, and ſeveral genera under one claſs or order, where the

the reſemblance in each particular ſpecies or genus is invariable and ſtrongly marked. Thus for the purpoſe of acquiring knowledge eaſily, we generalize, we arrange, we ſeek grounds of reſemblance. In Narrative Hiſtory, where nature is conſidered as active, we generalize her operations; and what in the combination of mere quieſcent forms, was only matter of arrangement, becomes here a foundation of ſcience, a law, a principle. It is in this way, that the flight of projectiles, the motions of the planets, the flux and reflux of the ſea, and a variety of other operations and appearances in nature are adequately explained by Sir Iſaac Newton on the principle of gravitation, and the firſt law of motion. From Narrative Hiſtory then we attain principles of ſcience, by generalizing, or viewing combinations of effects in their points of reſemblance. By generalizing in Deſcriptive Hiſtory, we obtain combinations from ſimilitude, which conſtitute the knowledge of mere arrangement.

The operations of nature being but different combinations of her quieſcent forms in an active ſtate, it is abſolutely neceſſary that our knowledge of the quieſcent forms ſhould precede that of active nature. Hence Natural Hiſtory ſhould precede Natural Philoſophy, where operations are generalized, and principles of ſcience thence obtained.

The firſt and moſt obvious diviſion of natural bodies that would preſent itſelf, is that into Animals, Vegetables and Minerals; or, as they are commonly deſigned, the Three Kingdoms of Nature. In making this diviſion, we loſe ſight of the points in which theſe three different claſſes of bodies concur, and only pay attention to the circumſtances in which they differ. It requires, however, a perfect knowledge of all the natural bodies on this globe, and their moſt intimate qualities, to form charac-

teriſtic differences which ſhall include every individual of one diviſion, and exclude the individuals of every other. As ſuch a knowledge has never yet been attained, we have not been able to fix preciſe boundaries to any of theſe kingdoms. The marches are ſtill obſcure and undecided: and ſuch uncertainty indeed has prevailed on this ſubject, that ſome learned Naturaliſts have diſputed the diviſion, being inclined to believe that all natural bodies are comprized in a kind of ſcale or chain, whoſe gradations are beautifully marked by the great variety in all the parts of Nature's productions. Man, as poſſeſſed of thought and intelligence, is placed at the top of this ſcale. The inconceivable variety among men ariſing from genius, character, capacity and force, gives riſe to as many degrees upon the ſcale of intelligence. As we deſcend, Reaſon ſeems to loſe itſelf, and be confounded with the finer inſtincts of the higher kinds of animals; as the monkey, elephant and horſe. Thus it is, they ſuppoſe, that the ſeveral beings in the world poſſeſs a place in this ſcale; and that ſuch is the number of gradations, and ſo inſenſible their progreſſion, that the lower link in a particular claſs of beings is, by imperceptible ſhades, connected with the higher link of a claſs of beings inferior in their nature to that immediately above it. It is in this manner that they would connect the moſt ſeemingly imperfect animals, as the Polypes, with the Senſitive Plant, which for that reaſon they conſider as joining the Vegetable and Animal Kingdoms. The Vegetable, which poſſeſſes the middle place, is likewiſe ſuppoſed to be connected with the Mineral Kingdom on the other hand. The duſty Byſſus, a ſpecies of Flag, ſcarce enjoys an apparent diſtinction from the earth on which it grows.

INGENIOUS however as this Scale of Beings undoubtedly is, and great as is its utility both in theory and practice, it ſeems moſt probable, that the three Kingdoms of Nature are perfectly diſtinct

diſtinct from one another, though men have not hitherto been extremely ſucceſsful in eſtabliſhing the characters of each diviſion. The truth is, that the amazing variety which obtains among natural bodies, ſo characteriſtic of Omnipotence, proves highly unfavourable to either poſition, and muſt render imperfect any method of diviſion which can poſſibly be deviſed. For if we aſcend from the irregular coaleſcence of the maſs of earth in the mineral kingdom up to man, as the moſt perfect animal, ſeveral bodies are found in the vaſt intermediate ſpace, which cannot be reduced but with the utmoſt difficulty into any certain and definite ſeries.

DIVERSITY of form in the ſame ſpecies is aſſigned by Ludwig, as the diſtinctive character of minerals; whilſt locomotive powers, according to that author, ſufficiently diſtinguiſh the animal from the vegetable. "When we attend," ſays Ludwig, "to the difference of natural bodies, we obſerve in ſome, "conſtantly the ſame form, ariſing from the figure, ſituation, connection and proportion of the parts: in others, "we obſerve no ſuch invariable form, but are led to determine their nature, from the mixture or aggregation of "the parts. The former are called Vegetables and Animals, and proceed from ſeed, and from an egg; the latter "Minerals, and ariſe from the coalition of particles meeting together from a variety of cauſes.

"THE ſeed being the vegetable egg, the difference now adduced ſerves not to diſcriminate vegetables from animals. "Betwixt theſe, however, a manifeſt difference obtains. For, "whilſt vegetables are devoid of loco-motive powers; that is, "cannot tranſport themſelves, by proper organs, from place to "place; the animal can perform his appointed motions by the

"parts

" parts proper to his frame; ſo that even if he is at reſt, we may " obſerve a diſpoſition or aptitude in his ſeveral limbs to un- " dertake their reſpective motions.

" NATURAL bodies, then, which have always the ſame " form or appearance in the ſame ſpecies, and are endued with " the power of motion, are called Animals, and are ſubdivided, " principally from the organs of progreſſion, into quadrupeds, " birds, fiſhes, amphibious animals, worms and inſects. The " doctrine of animals is termed Zoology.

" NATURAL bodies which have always the ſame form in the " ſame ſpecies, and are devoid of loco-motive powers, are called " Vegetables or Plants. The doctrine of vegetables is termed " Phytology or Botany.

" NATURAL bodies which have a different appearance in the " ſame ſpecies, and although they frequently agree in the inter- " nal maſs, differ in external ſtructure, are called Minerals. The " doctrine of minerals is termed Mineralogy. This kingdom " of nature is frequently ſtiled the foſſil kingdom, becauſe ſeveral " bodies pertaining to it are dug out of the bowels of the earth. " Others, as Linnæus, call it *regnum lapideum*, becauſe the great- " eſt part of bodies belonging to it have earth for their baſis. " The term Mineral, is, perhaps, to be preferred, as ſeeming " to indicate a body formed by the coalition of earthy particles " variouſly mixed together.

" WE allow," ſays Ludwig, after enlarging upon this diſtinction, " that the differences juſt propoſed, are often not ſuffi- " ciently circumſcribed in their limits. The *urticæ marinæ*, " and other zoophytes, ſeem to open a communication betwixt " animals

"animals and vegetables; as do the moſſes, lichens, lithophyta "and chryſtals betwixt the latter kingdom and that of mine- "rals. Yet as the principal claſſes of natural bodies" (continues he) "may thence be certainly enough defined, we reſt in this "diviſion, being perſuaded that doubts of a ſimilar nature will "ariſe upon the foundation of any mode of arrangement what- "ever."

FAVOURABLY, however, as Ludwig is inclined to think of this diſtribution, it is far from being either exact or ſatisfactory. Chryſtals and petrefactions have always a regular figure in the ſame ſpecies. There are plants which are not fixed to one place, and animals which are, as Corallines, and ſome of the teſtaceous tribe. Linnæus's diſtinction, after Jungius, is much more accurate. "Lapides creſcunt; vegetabilia creſcunt & vivunt; "animalia creſcunt, vivunt & ſentiunt." That is, as it is well illuſtrated by a modern author, minerals have increaſe without life, organized parts, regular growth or ſenſation. Vegetables have a regular growth and a degree of life, but no ſenſation. Animals grow, live and feel. Minerals have no veſſels. Vegetables have veſſels for their nutritive juices. Animals have nutritive veſſels and nerves, a peculiar and diſtinct ſyſtem and the cauſe of ſenſation. Here then we have found an eſſential, univerſal and invariable difference of the three great claſſes or kingdoms of nature. Minerals wanting veſſels, though they may be encreaſed by an addition of parts, cannot have a regular growth; for that muſt depend on organized veſſels. Plants having veſſels, may have a regular growth; for it is the effect of their proper office: but wanting nerves, they cannot feel; that being the quality of nerve alone. Animals, which have nutritive veſſels and nerves, grow and feel; theſe being the offices of thoſe two ſyſtems.

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THIS fixed character being eſtabliſhed, the ſenſitive plant and ſome other well-known inſtances ſtill recur. All that can be ſaid with reſpect to ſuch inſtances is, that they are exceptions to the general law of their being; for nature makes all her changes by minute gradations, and leaves no great gap in the univerſal chain. In fine, a diſtinctive character being eſtabliſhed, there can be little difficulty or confuſion.

VEGETABLES then are placed in a middle ſtate, between the ſentient animal and the unorganized mineral; inferior to the former, ſuperior to the latter. Animals and vegetables agree in many particulars. They grow, and are nouriſhed. They are furniſhed each with an organized ſtructure, that is, conſiſt of parts which co-operate in producing the changes that are effected in their frame. The nouriſhment, which they receive in a very different manner; the vegetable from the ſoil in which it is placed; the animal ſearching about in queſt of it; is filtrated through the veſſels, and by a proceſs which we cannot explain, aſſimilated to the ſubſtance of the plant or animal, ſo as to repair its waſte, and increaſe its growth. Thus an analogy manifeſtly obtains betwixt vegetation and the animal œconomy. The root attracting moiſture from the ſoil, and abſorbing it, may aptly enough be compared to the ſtomach and lacteals of animals; the courſe of the ſap to the circulation of the blood; the abſorption of the redundant moiſture by the ſun, to animal perſpiration. Accordingly ſuch terms have been invented, and we ſpeak of the circulation of the ſap, the perſpiration and reſpiration of plants. Strong, however, as this analogy is, we cannot explain any of the facts in the one ſubject by thoſe of the other. Their laws and *modus operandi* are quite diſtinct. No fact in vegetation can explain animal heat. In fine, mechanics, vegetation, animal œconomy, and intelligence, are ſubjects that are quite diſtinct, totally indepcndent, and can never explain each other.

SECTION

SECTION II.

The extent of Botany, its advantages, and the obſtacles that have retarded its progreſs.

THE preceding ſection eſtabliſhed the geography of my ſubject, by fixing its limits, and aſcertaining its preciſe place in the extenſive department of natural knowledge. I propoſe, in this ſection, as a proper introduction to this part of the work, to lead the reader into an enquiry reſpecting the advantages which attend the ſtudy of Botany, the extent of that ſcience, and the difficulties which have proved obſtructive of its progreſs.

NATURAL hiſtory, in its ſeveral branches, is an entertaining as well as uſeful ſtudy. To the former of theſe characters, none, I am confident, will diſpute its claim. Thoſe even who have been moſt laviſh in invectives, allow it to poſſeſs this merit: if that can, with propriety, be ſaid to poſſeſs any merit whatever, which has not utility to recommend it. And, indeed, what ſtudy can be more entertaining; nay, I will go farther, what can be a more rational and manly ſtudy than that by which we attain an acquaintance with the works of nature! The curious inſtincts of animals, the beautiful variety in the vegetable tribes, the hidden wonders of the foſſile kingdom, are objects which awake attention, and prove an inexhauſtible fund of pleaſure and delight.

INDEPENDENTLY of its utility, the ſtudy of natural hiſtory is with peculiar propriety recommended to ſuch as enjoy ſtill life, or who intend to viſit foreign countries.

NOTHING can be more ſuited to the innocence and gay ſimplicity of the country than the ſtudy of Botany. No ſituation can be more favourable for ſuch a ſtudy. The country is Nature's perpetual reſidence; it is there ſhe puts on her richeſt attire; it is there ſhe appears in her moſt engaging charms: and void is he of ſenſibility indeed, who can view with unconcern ſuch artleſs beauties!

To acquire a knowledge of the natural productions of their own country is now pretty generally an object with gentlemen who enjoy the advantages of a liberal education. To travel with profit, we muſt extend our views. From difference of ſoil, climate, and a variety of concurring cauſes, nature, in different countries, aſſumes very different appearances. Let us familiarize ourſelves to theſe appearances, and, not contented with a bare knowledge of nature as ſhe exhibits herſelf to us at home, let us view her in the various modes and dreſſes which ſhe is pleaſed to aſſume.

A TRAVELLER very naturally enquires into the geography of the countries which he purpoſes to viſit, their boundaries, extent and ſituation, their cities, mountains and rivers; the manners and cuſtoms of the people, their policy and government. The man, curious in nature, will go a ſtep farther; he will make himſelf acquainted with the internal geography, if I may be allowed that expreſſion, of the different countries through which he is to paſs. His knowledge will not be confined to the ſituation and extent of rivers, foreſts and mountains; he will likewiſe know what

what he is to expect in those rivers, in those forests, and on those mountains.

I SAID, that natural history is an useful study. Can we for a moment doubt it, when we recollect that it furnishes one of the strongest arguments for the existence of a supreme intelligent Being? To produce a stronger proof of its utility is impossible: to enforce the study from other motives is unnecessary. The works of God are the most easy and intelligible demonstrations of his being and attributes; and he who carefully studies those works may be truly said, in the beautiful language of the poet, "To look through nature up to nature's God."

BUT to be convinced of the utility of Botany, let us consider its extent. And here it is to be observed, that, in our researches into natural bodies, we either pay attention to the external surface only, and the corporeal properties obvious to the senses, particularly to that of sight, and thence institute the distribution into genera and species; or we search into the internal fabric, by dissecting or resolving the parts which are constituent of the bodies, and thence deduce their origin and changes. The knowledge resulting in the first case is called the historical knowledge of nature, or natural history, properly so called; in the latter case, the scientific or physical knowledge of nature. What obtains with respect to natural history in general, holds also in considering the parts of which it is composed. Thus, Botany, a part of natural history, is either historical or physical. Physical Botany, or the philosophy of plants, treats of the constituent parts of vegetables, their internal fabric or structure, their fluids and solids, and the motion of the former through the latter. Hence the circulation of the sap, the perspiration and respiration of plants by the leaves, and a variety of curious phæ-

nomena in the vegetable œconomy connected with gardening, arrange themſelves under the extenſive head of Phyſical Botany.

IMPORTANT as the philoſophy of plants certainly is, it cannot be denied, that the various diſtributions into ſpecies and genera from circumſtances of reſemblance in the external forms and appearances of plants, and the numerous ſyſtems or combinations thence ariſing, are the proper objects of Botany. Hiſtorical Botany then is Botany properly ſo called; and to have an accurate and extenſive diſtinctive knowledge of plants, as connected by ſimilitude, or ſeparated by contraſt, is to be an expert botaniſt. "Botanicus," ſays Linnæus in the Preface to his *Genera Plantarum*, "eſt ille, qui vegetabilia ſimilia ſimilibus, & "diſtincta diſtinctis nominibus, cuicunque intelligibilibus, noſcit "nominare." The ſame idea predominates in Boerhaave's definition of Botany, which, according to that learned author, is "a part of natural knowledge, by means of which, plants are "moſt certainly and eaſily known, and engraved on the me-"mory."

BUT whither does all this tend? For as yet we have ſeen no uſeful purpoſe that ſuch a diſtinctive knowledge, however extenſive, is calculated to promote. Is it then to be acquired merely for its own ſake? Or would the pleaſure derived from ſuch an uſeleſs acquiſition make amends for the labour and time which had been ſo improperly and fruitleſsly beſtowed? Let us pay attention to theſe queries; they will, perhaps, lead us to obviate one of the ſtrongeſt objections that can be made to the ſcience of Botany.

I BEGIN with obſerving, that a diſtinctive knowledge of the ſeveral orders of plants, ſuch as can be acquired by inſpection alone, the moſt intimate acquaintance with the various reſemblances

blances and contraſts upon which thoſe orders are founded, are of little importance conſidered by themſelves. A man poſſeſſed of ſuch knowledge, without applying it to any uſeful purpoſe, has, indeed, ſpent a great deal of time ingeniouſly upon trifles, which might have been more honourably devoted to the good of ſociety, and the exertion of genius. Unintereſting, however, and even detrimental as acquiſitions of this kind may prove, when attained merely for their own ſake, their tendency to promote the purpoſes of uſeful ſcience is indiſputable; and where that tendency is ſeconded by proper induſtry and application, the acquiſitions themſelves muſt riſe proportionally in our eſteem. With propriety, therefore, is Botany divided into two great parts; the firſt, reſpecting the knowledge of the ſeveral parts of vegetables, and their various aſſemblages, as connected by reſemblance, or diſtinguiſhed by contraſt; the ſecond unfolding their properties, virtues and medicinal powers. The relation betwixt theſe parts is mutual and dependent. The latter cannot be acquired without a competent knowledge of the former; the former, though attainable without any ſuch aſſiſtance, derives its utility from its application to the latter.

The reality of this mutual dependance betwixt the two grand objects of botanical knowledge may be inferred from the want of ſucceſs which has accompanied every attempt to diſunite parts ſo cloſely connected. The ancient Botaniſts, particularly Ariſtotle, ſeem to have paid very little attention to the reſemblances on which a diſtinctive knowledge of plants is founded; their aim was, to poſſeſs themſelves of the uſeful part of the ſcience, without encountering its difficulties. The event, however, has ſhewn, that they were egregiouſly miſtaken; and, that, by endeavouring to aſcertain the powers of vegetables, without a previous

vious knowledge of vegetable arrangement, they, in effect, laboured to attain an end, without uſing the proper means to accompliſh it.

SENSIBLE of the inconveniencies to which this error had ſubjected the ſeveral departments in natural hiſtory, the moderns have beſtowed their attention principally on deſcription and ſyſtematic arrangement; and, from an exceſs of refinement, too common in modern times, have hurried into an error of much worſe tendency than that which they laboured to avoid. A nice and ſcrupulous attention to the minutiæ of ſcience is the characteriſtic diſtinction of the preſent age; and in no ſcience is this minutely diſcriminating ſpirit ſo conſpicuous, or ſo detrimental, as in Botany. Not that to diſcover reſemblances, even the moſt trifling, is in itſelf hurtful to ſcience; on the contrary, every ſuch diſcovery, if properly digeſted, is an acceſſion to ſcience. But it is to be feared, that, in proportion as theſe minute reſemblances engroſs the attention, we ſhall loſe ſight of the great object of our purſuit; and, involved in fancy and chimæra, ſtop ſhort at the means, without having either inclination or ability to attain the end. In fine, we ſhall reſt in a bare knowledge of vegetable productions, without applying it to thoſe purpoſes which alone determine its utility.

BUT from all this it were quite unphiloſophical to conclude that natural hiſtory in general, or botany in particular, is an uſeleſs ſtudy. The very beſt things are liable to be abuſed. But is ſuch an abuſe to be employed as a ſolid argument of their futility and uſeleſſneſs? By no means. The ſame ſcience which has been diſgraced by a butterfly-catcher, or a hunter after cockle-ſhells, is immortalized by the labours of a Bacon, a Boyle, and a Linnæus.

PRE-

PREJUDICES, however, of this kind, have been entertained; and, becauſe a diſtinctive knowledge of plants muſt neceſſarily precede that of their virtues and medicinal powers, men wrongly imagined that claſſing and arranging plants according to certain minute reſemblances was the ſole buſineſs of the botaniſt. They condemned, therefore, the ſcience as frivolous and uſeleſs, becauſe, perhaps, ſome had ſtopt ſhort in the road, without ſeeking to obtain what ſhould have been the main object of their purſuit.

I FIND I have been inſenſibly led from the advantages that attend the ſtudy of Botany to its difficulties; and of theſe we have already encountered the moſt formidable. Let us take a ſhort view of ſome other circumſtances in the nature of the ſcience which have been found obſtructive of its progreſs.

WHERE the differences are ſtriking, the knowledge of a ſubject is eaſily obtained. Plants are remarkably ſimilar in their form and appearance, and are therefore extremely difficult of inveſtigation.

ADD to this, that the objects about which Botany is converſant are exceedingly numerous and minute. They can therefore only be diſtinguiſhed by minute examination, which few, but thoſe of a curious turn, are diſpoſed to afford them; and hence the progreſs of the ſcience has been at all times ſlow and inconſiderable.

THE confuſion too that has ever prevailed in botanical language, and which is not yet totally removed, has been a mighty impediment to its progreſs; and the great uncertainty in fixing the genera, which Linnæus, the Father of modern Botany, has at length

length accompliſhed, added to the other difficulties already mentioned, muſt have given a beginner a very unfavourable idea of the ſcience he intended to ſtudy.

BEFORE I leave this ſubject, I muſt take the freedom to mention that I am not amongſt the number of thoſe who think that the ſcience has been injured, or rendered more difficult by the great number of methods, or, as they are called, ſyſtems, which have been conſtructed for arranging vegetables. As each of theſe ſyſtems is founded upon the ſtructure of a particular part of the plant, it is evident, the greater number of ſyſtems we are acquainted with, the more knowledge ſhall we have acquired of the different parts upon which ſuch ſyſtems are founded. By an arrangement from the ſtructure of a particular part, as the root, I am led to conſider that part with attention, as it exhibits itſelf, not in a few plants, but through the whole vegetable ſyſtem, when, perhaps, without ſuch a remembrancer, I might be apt to diſregard or overlook it altogether.

HAVING in this manner endeavoured to obviate the principal objections which have been made to the ſcience of Botany, and enumerated the chief difficulties which it has encountered in its progreſs, ariſing almoſt ſolely from an ill-grounded opinion of its being little elſe than a ſimple nomenclature, or, at beſt, calculated merely for amuſement: I ſhould now proceed to direct the reader's attention to the main object of this prefatory VIEW, for exploring which he is now ſufficiently qualified. It will not, however, be improper previouſly to mention the apparatus with which every beginning Botaniſt ought to be furniſhed for the more eaſy and accurate examination of plants; and to that purpoſe I ſhall dedicate the remaining part of this ſection.

THE

THE apparatus in queſtion is as follows:

A SMALL magnifying glaſs for viewing the minute external parts, as thoſe of the flower and fruit. Linnæus's genera, the characters of which are taken from very minute parts, render ſuch a glaſs abſolutely neceſſary.

A SHARP needle for diſſection.

A MICROSCOPE for viewing the internal ſtructure, and thoſe external minutiæ which elude the naked eye.

A BOTANICAL knife.

ON herborizing excurſions into the country, a ſmall tin box for containing ſpecimens of the plants which have occurred in the progreſs. Dillenius was the author of this invention.

IN diſſecting plants, particularly with a view of inveſtigating their ſeveral internal parts, and ſeparating them from one another, maceration in water is neceſſary.

PUTREFACTION too is of ſingular uſe in this reſpect.

WHERE ſpecimens cannot be procured, the botaniſt ſhould have recourſe to the beſt engravings of the ſeveral parts, as Tournefort for the external, Grew for the external and internal parts; Blackwell's herbal, Miller's figures, and *Flora Lapponica*, for the entire plant.

IN the delineating of plants by figures, Columna, Dillenius, Aubriet and Ehret, are eminent. The two former were profeſſed Botaniſts; the two latter artiſts, who, by long experience, became Botaniſts. Such figures, to be perfect, ought to exhibit

all the parts, even the moſt minute. Particular attention is likewiſe to be given to their ſituation and natural ſize.

THE beſt figures on wood are thoſe of Geſner and Rudbeckius; on copper, Ferrarius, Dodart in 1676, Breynius, Commelin, Loeſel, Rheede in 1678, Hermannus, Tournefort in 1694, Vaillant in 1718, Micheli in 1729, Haller in 1742, and Millar the Engraver, in his ſeries of plates explanatory of the Linnæan ſyſtem in 1770; on tin, Dillenius; out-lines without ſhade, Brunsfelſius in 1530, Fuchſius in 1542, Cluſius in 1576, and Father Plumier in 1693, illuminated or coloured after nature, Martin in 1728, Blackwell, Cateſby in 1731, Weinman, Ehret in 1748, Trew in 1750, and Millar in 1770; engraved or impreſſed from the leaves themſelves, Heſſelius's American plants in 1707; and Knipphofius, a German, in 1733.

OF Botaniſts who have written an Univerſal Hiſtory of plants, the moſt eminent are J. Bauhin, Moriſon and Ray. Of partial hiſtories, or the deſcription of a particular claſs of vegetables, are Dillenius's arrangement of the moſſes; Sceuchzer and C. Bauhin's deſcription of the graſſes; Plumier's American ferns; Pomet, Valentine, and Godfrey on the officinal plants.

OF ſuch as have employed their reſearches upon one vegetable only, the principal are, Dillenius on the *ficoides*, or fig-marigold; Boerhaave on the *protea*; Kempfer on tea; Haller on garlic, and the mountain ſpeedwells; Breynius on the famous ginſeng of China; Bradley on the aloe; and Linnæus, in ſome detached pieces in the *Amœnitates Academicæ*; ſuch as the diſſertation upon the dwarf birch, the plantain tree, the fig, paſſion-flower, *lignum colubrinum*, and ſeveral others.

AMONG

AMONG the enumerations of the indigenous or native vegetables of any particular place or country, or, as they are called, Floras, may be ranked in the firſt place Linnæus's *Flora Suecica*, and *Lapponica*; Haller's *Helvetica*; Ray's and Hudſon's *Anglica*; Magnolius's *Monſpeliaca*; and Gmelin's *Sibirica*.

AN enumeration of the plants that are cultivated in any garden, whether public or private, is termed by Botaniſts, *Hortus*. The moſt eminent of theſe are Linnæus's *Hortus Cliffortianus*; Gouan's *Hortus Monſpeliacus*; and in England, lately publiſhed, Hill's *Hortus Kewenſis*, containing a catalogue with ſhort generic characters of the numerous and valuable collection of plants in the botanical area of the gardens at Kew.

OF travels for the improvement of botanical knowledge, the moſt noted are, Sceuchzer's journey over the Alps; that of Calceolarius and Pona to Mount Baldus; Ray's travels and voyages; Tournefort's voyage to the Levant; Adanſon's voyage to Senegal; Gmelin's travels into Siberia; and lately publiſhed, under the auſpices of Linnæus, the travels of Dr. Frederic Haſſelquiſt into the Eaſt, for the purpoſes of advancing natural knowledge. The reader, curious in theſe ſubjects, may likewiſe conſult Proſper Alpinus and Shaw on the plants of Egypt; Sloane and Brown's natural hiſtory of Jamaica; Rheede's plants of Malabar; Hernandez and Feuillé on the plants of Mexico and Peru; and the valuable collection publiſhed by that ingenious traveller, Kempfer, by the title of *Amœnitates Exoticæ*.

THE beſt writers on the anatomy and phyſiology of plants, and the vegetable œconomy are, Grew, Malpighi, Duhamel, M. Bonnet, Geſner, Ludwig, and the late learned Dr. Stephen Hales, in his excellent treatiſe, entitled, Vegetable Statics.

The powers of vegetables, and their influence upon the human body, have employed another ſet of writers, as Pomet, in his hiſtory of drugs, and the numerous writers on the *Materia Medica*. Geoffroy and Tournefort have conſidered plants in this light as chemiſts; Porta, Bodenſtein, and Pappen as aſtrologers; Haſſelquiſt and Camerarius as botaniſts.

On the culture of plants, or gardening, the moſt approved Engliſh authors are Bradley in various pieces, and Miller in his Gardener's Dictionary.

For an explanation and application of the ſexual ſyſtem, the reader muſt conſult all Linnæus's books, particularly the *Philoſophia* and *Critica Botanica*; *Sponſalia*, *Genera & Species Plantarum*, and the ſecond volume of the *Syſtema Naturæ*. The firſt-mentioned book contains the rudiments of the ſcience, as new-modelled by Linnæus. The ſecond is a rationale of the new botanical nomenclature; the third contains the arguments for the ſex of plants, with a particular illuſtration of the method founded by the author upon that doctrine. The *Genera Plantarum*, to a tranſlation of which this View of the State of Botany is prefixed, contains exact and compleat deſcriptions of the parts of the flower and fruit, and is an application of the terms reſpecting thoſe parts delivered in the *Philoſophia Botanica*. In examining flowers therefore, with regard to their minute parts, and their ſeveral modifications, the book juſt mentioned muſt be our conſtant companion.

The *Syſtema Naturæ* contains the eſſential characters only of the genera, together with the ſpecific differences, or characteriſtical marks of all the known ſpecies of each genus. This book then begins to be uſeful after a competent knowledge is obtained

obtained of the parts of the flower and fruit by the aſſiſtance of the *Genera Plantarum*, and the object is, not to apply terms, but to explore plants. It is then that by comparing the eſſential or ſtriking characters in the *Syſtema Naturæ* with thoſe of the plant to be diſcovered, we can, with great facility, aſcertain the genus in queſtion; and, by applying the terms uſed to denote the ſpecies, the ſpecies alſo.

As the ſpecies can in this manner be explored by the aſſiſtance of the *Syſtema Naturæ*, the uſe of the book entitled *Species Plantarum*, may ſeem, in ſome ſort, to be ſuperſeded. The fact however is, that the laſt-mentioned work is not ſolely uſeful in detecting the ſpecies of plants: it contains likewiſe the ſynonimous names of the moſt approved authors, together with the place of growth, and duration of each particular ſpecies: and is chiefly calculated for the experienced Botaniſt, whoſe object is not to explore plants, but to obtain as much information as he can from different authors reſpecting the hiſtory of plants already known.

The ſcientific, or technical terms of Botany, as new-modelled by Linnæus, are collected by that author in his *Philoſophia Botanica*, and arranged in a particular order by Johannes Elmgren, a pupil of that celebrated Naturaliſt, in a paper publiſhed in the ſixth volume of the *Amœnitates Academicæ*. Theſe terms, by reaſon of their number, and the great confuſion that obtains among them, give no ſmall diſcouragement to the beginning Botaniſt. In a ſcience of ſuch minute inveſtigation as Botany, and where the ſubjects to be examined are ſo remarkably ſimilar, the neceſſity of the utmoſt preciſion is obvious. Till very lately, however, the nomenclature of this ſcience was exceedingly defective in this reſpect. Linnæus has totally reformed the language

guage of Botany, and, indeed, in a great meaſure, introduced a new language into the ſcience. The Linnæan terms, notwithſtanding, are far from being unexceptionable. Of Greek original, they caſt an air of obſcurity, and even myſtery, over a ſcience which, of itſelf, is ſimple and perſpicuous. Many of them too are totally unclaſſical; few convey the meaning readily; not to mention the great number of ſynonimous terms, than which there can be no greater imperfection in ſcientific language. The ſource of this error is to be traced in the bad arrangement or diſpoſition of the terms themſelves. All ſcientific terms are properly divided into general, and ſpecial or particular. Such a diviſion prevents the uſe of ſynonimous terms. General terms I call ſuch as can be applied to all the parts of plants indiſcriminately, and may be arranged under certain modes, as of duration, figure, place, ſituation, ſurface, margin, ſummit. The particular or ſpecial terms are ſuch as apply to a particular part only. Thus, whatever is peculiar to the root, ſtem, or any other part of the plant, is arranged with the ſpecial or particular terms belonging to that part. Whatever applies not only to the root or ſtem, but to all the parts indifferently, is a general term, and arranges accordingly.

The language of Botany being now eſtabliſhed, it is difficult, by the method juſt propoſed, to give a general ſignification to ſuch terms which ſhall apply to every part indifferently. The alteration now offered is rather intended as a ſpecimen of the manner in which the language ought to have been originally conſtructed, than as a perfect reformation of its preſent conſtruction. For as the ſame general term applied to different parts has originally received a different meaning, it is impoſſible, by new-modelling the method or arrangement, to remove that inconvenience,

convenience, unleſs by altering the ſignification of terms, and thus, in effect, inſtituting a new language.

Of the application of each term, the beginner need not be ſollicitous for examples: ſpecimens of the moſt uncommon or remarkable are ſufficient; and frequently a juſt and preciſe explanation will ſuperſede the neceſſity of either ſpecimen or figure.

The laſt auxiliary to the beginning Botaniſt that I ſhall mention, is the uſe of thoſe collections of dried plants, generally known by the name of *Herbaria* and *Horti ſicci*. In collecting plants for this purpoſe, care is to be taken that they are not gathered when moiſt, and that they be kept from moiſture afterwards. They are likewiſe to be compleat in all their parts, even to the minuteſt organ of fructification. The proceſs of drying, and diſpoſing them on paper, is not ſubjected to rules, being entirely directed by the fancy of the collector. Some fix the plants to the paper with glue, others ſtick them into it; and a third ſort faſten them upon it by means of pins. The ſecond method is, in my opinion, preferable; for the glue proves frequently detrimental to the plants, and if diſpoſed by the latter method, they are always apt to drop out. One plant only is to be placed betwixt each ſheet, which ought to have a moderate weight laid upon it, and to be turned at leaſt once in twenty-four hours. When the collection is compleated, or even immediately after it is begun, if agreeable to the collector, the plants are to be arranged according to ſome approved ſyſtem; and the names, both generic and ſpecific, together with ſome circumſtances reſpecting its hiſtory, to be affixed to each ſpecies. Linnæus has deſcribed a cheſt capable of containing ſix thouſand dried plants, in which the diviſions or cells correſpond to the number of claſſes in the

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ſexual method, and differ in dimenſions according to the greater or leſs number of ſpecies in each claſs.

THE moſt conſiderable collections of this ſort in England are, Dr. Sherard's, which conſiſts of 12000 ſpecies; and Sir Hans Sloane's, now depoſited in the Britiſh Muſæum, which contains 8000. In France, the moſt noted are, that of Tournefort, which contains 4000; that of Vaillant, which contains 12,000 ſpecies and varieties; and thoſe of Juſſieu, and M. Adanſon, which contain each about 10,000 ſpecies and varieties. Theſe are gardens which flouriſh when vegetation is no more, which pleaſe by the ſurprizing variety they diſplay, and are rendered eminently uſeful by the facility with which the natural hiſtory of countries the moſt remote from each other is, by ſuch means, acquired.

SECTION

SECTION III.

Natural and Artificial Methods diſtinguiſhed.

THE terms Syſtem and Method are frequently uſed, without any preciſe idea being affixed to either. Before, therefore, we can pronounce with certainty of the merits of any methodical diſtribution whatever, we muſt remove this ambiguity, and give a determinate meaning to the words in queſtion.

A SYSTEM then is a mode of arrangement by which a number of detached or complicated ideas are reduced to one ſimple and general idea founded upon principles demonſtrated neither to be abſolute nor true, but ſuppoſed ſuch, with a view of conducting to ſome important knowledge, of which we are ignorant. Diametrically oppoſite to this method of compoſition, termed Syntheſis, is that by which a whole is decompounded into its moſt ſimple parts. This mode of reaſoning is ſtiled Analyſis; and the deſcription of thoſe ſimple parts which are its object, Definition. What poſition, or the rule of falſe, is in Arithmetic, Hypotheſis or Syſtem is in Phyſics. In both, the ſuppoſition, which is often manifeſtly falſe, leads in ſome caſes either directly to the truth, or to ſome circumſtance that is ſo connected with it, as to render the diſcovery unavoidable. I ſay, in ſome caſes, becauſe moſt commonly ſuch ſyſtems lead only to conjectures, to paradoxes, and analogies contradicted by the ſenſes.

A METHOD is an arrangement of bodies approximated by ſome agreements or reſemblances in the bodies themſelves. The idea or principle reſulting from theſe agreements, is general, and applicable to all the bodies indiſcriminately; but is never regarded as abſolute, invariable, nor indeed ſo general, as in no caſe whatever to admit of exceptions.

THUS the ſole difference betwixt method and ſyſtem conſiſts in the different idea which the author attaches to his principles, regarding them as variable and leſs general in the former, as abſolute and invariable in the latter. In excellence, therefore, ſyſtem muſt manifeſtly yield to method, from its extreme uncertainty, and tendency to deceive.

IT has been ſaid that a previous knowledge of vegetable arrangement, far from being ſo neceſſary as is pretended, does not even facilitate the knowledge of plants: and a ridiculous diſtinction has been ſuggeſted, whereby to know plants *ſyſtematically*, and to know them *practically*, have been placed in direct oppoſition to each other, as ſubjects, that if not abſolutely incompatible, are, at leaſt, perfectly diſtinct and totally independent. I know but of one caſe, and that not attended to by the authors of this diſtinction, in which it can, with any degree of propriety, be vindicated. The rationale of any ſyſtem, its plan, its principles, may be compleatly acquired, without the previous knowledge of a ſingle plant. I can conceive a novice in what is called the practical part of Botany a compleat maſter of the theory: in ſo far the theory is independent of the practice. But will it be ſeriouſly affirmed that the practice is equally independent of the theory? Or can it be pretended that there is a man to be found thoroughly verſed in plants, and yet totally ignorant of the principles of Botany or ſyſtematic arrangement? What then is the

practical

practical knowledge of plants ſo much inſiſted on? An application of the principles of arrangement, which, however independent of that knowledge, is only uſeful as it conduces to its advancement. Suppoſe an ignorant nurſery-man, pluming himſelf upon the knowledge he had acquired at ſecond-hand, of the few plants raiſed in his garden from ſeeds which, together with their names, had been tranſmitted to him from different countries, ſhould aſſert the ſuperiority of his practical knowledge, as he would undoubtedly term it, and throw the moſt illiberal invectives on ſcientific principles which he had not capacity to comprehend, I would ſtop his career, by enquiring in what his ſo much boaſted knowledge conſiſted, and whether it was at all communicable to others? To this laſt interrogatory he would doubtleſs reply in the affirmative; and yet the truth is, that ſuch a pretender to ſcience cannot diſtinguiſh between one plant and another, nor of conſequence, communicate to others his cauſe of knowledge. When he ſees a Magnolia, a Kalmia, a Browallia, he remembers the names by which the plants in queſtion have been tranſmitted to him; but it is the names only that he remembers; for aſk him by what invariable marks or characters he recognizes ſuch and ſuch plants, his ſilence as well as ſurprize give conviction of his ignorance. Such is the practical knowledge of plants that is acquired independently of ſyſtematic arrangement!—a knowledge which is neither diſtinctive, nor can be communicated to others, as its cauſe cannot be aſſigned.

BOTANISTS have diſtinguiſhed two kinds of methods, natural and artificial. The excellence of the former has been fully commemorated by almoſt every writer on Botany. Its claſſes or primary diviſions are true natural families founded upon numerous, permanent and ſenſible relations, which are eſſentially the ſame in all the plants of each particular family or aſſemblage.

Thus the whole vegetable kingdom is diſtributed by nature into a ſort of progreſſive ſcale, the claſſes or diviſions of which run inſenſibly into one another, as do likewiſe the ſeveral individuals of each claſs. It is not therefore only the natural families which it imports us to know; we muſt alſo detect the order which nature obſerves in arranging them, and connecting the ſeveral individuals with one another. It is this which makes the diſcovery of that great deſideratum in Botany, a natural method, almoſt impracticable: for whilſt links in the great chain are either miſplaced or deficient; whilſt chaſms remain to be ſupplied; in a word, whilſt a ſingle plant remains undetected, the order of nature muſt ſtill be involved in obſcurity, and our knowledge of the natural tribes that have been already diſtinguiſhed, rendered, in ſome ſort, uſeleſs. Thus the principal impediment to the diſcovery of a natural method, it is only in the power of induſtry, by a proper exertion of its talents in the detection of new ſpecies of plants, to leſſen or totally remove. Animated as I would wiſh every botaniſt by ſo encouraging a circumſtance, I cannot help expreſſing my doubts, that, if detected, ſuch a natural method as that I have been deſcribing, would not greatly facilitate the knowledge of plants. The fact is, that the different genera of each family or tribe are connected by ſuch numerous relations, that, though poſſeſſed of the order of nature, we ſhould be apt to miſtake one genus for another, nay not ſeldom to incorporate all the genera of one natural family into one huge genus. It is in this way that the genera of the lip, pea-bloom, croſs-ſhaped flowers, and ſome other natural orders of plants, are not diſtinguiſhed but with the utmoſt difficulty: an inconvenience which is greatly increaſed from this circumſtance, that the genera in ſuch orders are frequently numerous. When I ſee a ſpecies of ſage, germander, bugle or lavender, the figure and ſituation of the flower, and general habit of the plant immediately determine

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me to refer each to the natural order of lip-flowers, or of plants which flower at the joints: but this is the only thing which I can immediately determine; for upon viewing the numerous liſt of plants which arrange themſelves under that aſſemblage or family, I diſcover ſo many reſemblances and ſo few differences, that I am almoſt tempted to make one enormous genus of the whole, till I reflect that by ſuch proceeding I gain nothing in point of facility, as the trouble thus ſpared by the diminution of genera is more than equalled by the prodigious multiplication of ſpecies. Thus the difficulty of applying a natural method, although, in fact, extreme, is not immediately perceived. For as a plant, by reaſon of ſome conſpicuous character, may be referred almoſt at ſight to its proper claſs or diviſion, we are not apprized of the difficulty, till, upon examining the genera, we find the agreements ſo numerous, and the differences conſequently ſo minute, that diſcrimination ſeems almoſt impoſſible, and we remain as ignorant of the plant to be explored as at firſt. As a proof of this aſſertion, it deſerves to be remarked that thoſe methods which have approached moſt nearly to the natural, either in the plan or execution, have been uniformly found the moſt difficult in practice. Such methods indeed are doubly intricate, becauſe all the claſſes not being ſtrictly natural, it is frequently as difficult to aſcertain the claſs as the genus. Beſides, as the claſſes in ſuch methods muſt neceſſarily be numerous, for the purpoſe of collecting all the natural families, it requires a multiplicity of ſteps to connect them together; and hence the clavis or key of the arrangement is perplexed and intricate. The learned reader, when he hears the names of Moriſon, Ray and Magnolius, quoted upon this occaſion, will agree with me in the fact and in the cauſe which produced it.

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As the order of nature is uniform, general and univerſal, that is, admits of no exception, but being totally independent of our will, is regulated by the nature of things, which conſiſts in the combination of all their parts and qualities; it is evident that there can be no natural method in Botany but that which ariſes from a combined view of all the parts of plants, and their relations. Into this view muſt enter the roots, ſtems, leaves, flowers, fruit, general habit; in fine, all the parts, qualities, properties and faculties of plants. From the ſymmetry of theſe parts, from their figure, number, ſituation and reſpective proportion, and from a compariſon of their qualities, agreements and differences, ariſes that affinity which approximates plants, and diſtinguiſhes them into natural Claſſes or Families. This idea, however, of a natural method, though moſt certainly the true one, is very different from that of Linnæus, who, diſregarding the habit or external port, and ſeveral other circumſtances juſt mentioned, confines himſelf merely to the ſymmetry of all the parts of fructification.

An artificial method collects genera which do not poſſeſs the greateſt number of relations neceſſary for approximating them to one another, although they agree in the characteriſtic mark or marks aſſigned to each claſs. From this definition it is evident that the characters employed in artificial methods, becauſe leſs numerous, are ſimpler than thoſe employed in the natural method. For the ſame reaſon, ſuch methods are infinitely more eaſy; becauſe the genera of each claſs not being connected by ſuch numerous relations, are eaſily diſtinguiſhed from one another: and the claſſic character generally depending upon a ſingle circumſtance, the claſſes, which, in moſt artificial methods are proportionably few in number, may be aſcertained with equal facility. As nature is uniform in all her operations, there can be

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but one natural method; whereas the number of artificial methods is almoſt inexhauſtible, ariſing from the combination of the different parts of plants, their figure, number, proportion, ſituation and other circumſtances.

I CANNOT better illuſtrate the difference, in point of facility, between natural and artificial methods than by reminding the reader of the two different ways of arranging words in a dictionary. The moſt natural method of arranging words would doubtleſs be to place all derivatives under their primitive, and all compounded words under their ſimple root. Such rational dictionaries, however, would be by no means uſeful to learners, nor anſwer the purpoſe that nomenclatures of this kind are intended to ſerve. Artificial dictionaries therefore were invented, in conſtructing which, no ſort of knowledge whatever was preſuppoſed in the beginner, ſave that of the order of the alphabet merely. A boy who knows his letters, and the order of their ſucceſſion, can turn up any word you dictate full as quickly as if compleat maſter of its derivation and etymology. There is no ſcience required. It is an eaſy ſuccedaneum for the rational dictionary juſt mentioned, which, however excellent, could only be uſeful to the learned, to whom the derivations and compoſitions of words are familiar. Artificial methods are to the natural, what the alphabetical dictionary is to the etymological. The characteriſtical marks of the claſſes correſpond to the letters of the alphabet, and the order of their ſucceſſion: the natural families and the order of their arrangement, to the etymological arrangement of words. The analogy is ſtrong; and the difference, in point of facility, may be explained, in both caſes, on the ſame principles.

FROM the definition delivered in the beginning of this ſection, it is evident, that every ſyſtem muſt be artificial, becauſe its principles are ſuppoſed to be abſolute and true, but not demonſtrated ſuch. Theſe ſuppoſitions may indeed ſometimes be realized in the ſequel, and demonſtrated to be true: in which caſe they ceaſe to be ſyſtematic principles, and become part of the natural order of things. It was this which happened to the planetary ſyſtem of Copernicus, when a ſufficient number of obſervations had confirmed beyond a doubt the relative diſpoſition in the orbs of the ſolar planets, which that ſyſtem had ſet out with ſuppoſing.

SYSTEMATIC Botaniſts are divided by Linnæus into two claſſes, termed *Orthodox* and *Heterodox*. The former have arranged plants by a method founded on ſome part of the flower or fruit: I ſay, on ſome part, becauſe the choice is arbitrary, though ſome of the parts are manifeſtly preferable to others. Heterodox Botaniſts are ſuch as have diſtributed plants from ſome part or circumſtance unconnected with fructification. Such were moſt of the writers during the rude ſtate of the ſcience: ſuch even are ſome modern authors of eminence, as Sauvage and Duhamel, who have ſuggeſted an arrangement from the leaves; and Miller, who leſs philoſophically ſtill, has digeſted the plants he deſcribes in alphabetical order. The numerous methods founded on the external habit or port, the time of flowering, place of growth, medicinal powers and ſome other circumſtances, are equally contrary to the genuine orthodox principles of ſyſtematic arrangement with thoſe of the authors juſt mentioned. The firſt orthodox Botaniſt was Cæſalpinus, a profeſſor at Padua, who, in 1583, gave riſe to the ſyſtematic æra of Botany, by the publication of an arrangement of plants founded upon the fruit, the idea of which he had received

ceived in 1560, from Conrad Geſner, an eminent phyſician of Switzerland.

As the following ſection will be ſolely employed in tracing the progreſs of method from its firſt and ſimpleſt rudiments in botanical writings to its preſent more improved ſtate, it would be improper to enlarge farther in this place upon the diſtinction which has juſt been ſuggeſted. I ſhall therefore diſmiſs this ſection with an explanation of the terms Univerſal, General and Partial Methods which frequently occur in diſſertations on botanical ſubjects.

An univerſal method is that which includes all the plants known at the time of its eſtabliſhment. Of this kind are the methods of Bauhin, Ray, Tournefort, Linnæus and many others.

A GENERAL method is converſant, like the former, about all the different claſſes of plants, but limits its reſearches to a particular ſpot, region or country, without including all known plants. Of this kind are thoſe enumerations of the native vegetables of any particular place or country, generally known by the name of Floras. Theſe catalogues, for they are no other, have multiplied exceedingly of late years; and it requires only a very ſlight acquaintance with the ſubject to divine the cauſe. When books can be made with ſo very little trouble as tranſcribing occaſions, all the world may turn authors. The catalogues in queſtion have certainly their uſe, and, in proper hands, might prove of eminent advantage, by being enriched with many valuable obſervations reſpecting the natural hiſtory of the ſeveral countries and provinces whoſe plants they enumerate. But at preſent they are little elſe than mere tranſcriptions from the *Species Plantarum* of the generic, ſpecific and ſynonimous names of

plants, with ſcarce a ſingle remark worth attention, or one deviation from the beaten path, which might diſplay ingenuity. The evil of this is, that illiterate people, tempted by the facility of ſuch an undertaking, may commence authors, and wading beyond their depth, contribute as effectually to miſlead the public, through vanity, as others through deſign. From this cenſure I would particularly exempt the ingenious M. Gouan, who both in his enumeration of the plants which grow naturally around Montpelier, and in his catalogue of the indigenous and exotic plants that are reared in the botanical garden at that place, has uſefully deviated from the common track, and, among ſeveral other intereſting particulars, prefixed to each genus its ſecondary characters, or thoſe derived from the habit and general appearance of the plants which compoſe it.

PARTIAL or particular methods are limited to the examination of a ſingle claſs of plants. Such are Vaillant and Pontedera's arrangement of the compound flowers; Moriſon and Artedi's diviſion of the umbelliferous plants; Ray, Monti, Scheuchzer, and Micheli's arrangement of the graſſes; thoſe of the moſſes, muſhrooms and flags by the laſt mentioned author, Dillenius, Gleditſch and Battarra.

SECTION

SECTION IV.

The progreſs of Method and Syſtematic Arrangement from its ſimpleſt Rudiments in Botanical Writings.

THE diſtinction of Heterodox and Orthodox Botaniſts, ſuggeſted in the cloſe of the laſt ſection, ſerves very properly as a foundation for the method to be obſerved in this. The firſt writers on plants, ſtudious to render Botany uſeful, were little ſolicitous about means to facilitate its knowledge. They collected the names of plants, their virtues, and œconomical uſes, and made what additions they could to the ſcanty original liſt. Mean while, arrangement lay either totally neglected, or, founded upon inſufficient principles, was little calculated to inſtruct. The period during which Botany continued in this uncultivated imperfect ſtate, I have choſen to deſign by the name of the Hiſtorical Æra; becauſe the knowledge which it inculcated, being confined to the names, number and virtues of plants, was profeſſedly of the hiſtorical kind. The other æra, which commences with Cæſalpinus, is properly denominated the Syſtematic Æra of the Science, from the orthodoxy of its methods, and genuine purity of the principles on which they proceed.

THE Hiſtorical Æra opens with Theophraſtus, who is very properly conſidered as the Father of Botany. For although, prior to the time of that elegant Naturaliſt, ſeveral writers are ſaid to have mentioned plants occaſionally, and even to have given deſcriptions of them; yet ſuch deſcriptions are either looſe and de-

ſultory, or have periſhed with the works in which they were contained. In this light we are to regard the writings of Zoroaſter the Perſian; thoſe of Orpheus, Muſæus, Heſiod, Homer, Solon, Pythagoras, Cratevas, and Hippocrates among the Greeks; and among the Jews, thoſe of Moſes and Solomon, the laſt of whom is ſaid "to have ſpoken of trees from the cedar that is "in Lebanon, even unto the hyſſop that ſpringeth out of the "wall." The greateſt part too of Ariſtotle's two books on plants, which are frequently quoted by himſelf, has periſhed in the general wreck of time; and the little that has eſcaped its undiſtinguiſhing fury has been ſo mangled and torn by the unſkilful, under the ſpecious pretext of ſupplying its defects, that we have only to lament, that the original work was not either totally preſerved, or totally loſt.

THEOPHRASTUS, the diſciple of Ariſtotle, was born at Ereſium in the iſland of Leſbos, and flouriſhed in the third century before the Chriſtian æra, being about 100 years poſterior to Hippocrates. His work, entitled the Hiſtory of Plants, is executed in a truly philoſophical manner. It treats of vegetation, of the origin and propagation of plants, of their anatomy and conſtruction, and of vegetable life. In a diſſertation of this nature, profeſſedly confined to the philoſophy of plants, it would be highly abſurd to expect a numerous catalogue, or a ſtudied well-digeſted plan of arrangement. The number of plants which his ſubject led him to deſcribe or mention amounts to about five hundred. Theſe he has arranged by a method, which, however unſyſtematical, ſeems extremely well ſuited to the rude ſtate of the ſcience, and was indeed partly ſuggeſted by his main ſubject. The work in queſtion originally conſiſted of ten books, one of which is loſt. In the remaining nine, vegetables are diſtributed into ſeven claſſes or primary diviſions, which have for their object the generation

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of plants, their place of growth, their ſize, as trees, and ſhrubs; their uſe, as pot-herbs and eſculent grains; and their lacteſcence; which laſt circumſtance reſpects every kind of liquor, of whatever colour, that flows in great abundance from plants, when cut. In this ſhort view of Theophraſtus's Hiſtory of Plants, I have confined myſelf merely to his method of arrangement. As a philoſophical treatiſe on the laws of vegetation, its eminence is indiſputable. The diction is remarkably elegant, and withal ſo perſpicuous and eaſy, that a ſtrict peruſal of the original cannot be too warmly recommended to botaniſts who have ſtudied the Greek language; I ſay, the original, becauſe there are many inaccuracies and errors in the beſt tranſlations, owing to an ignorance in the tranſlator of the terms of botany.

The next Botaniſt of note was Dioſcorides, by birth a Grecian, but under the Roman empire. The number of known plants, their virtues, and the names by which they were diſtinguiſhed both in Greece and the adjacent countries chiefly employed the attention of this indefatigable botaniſt. That the ſcience, however, was ſtill in its infancy, appears from this remarkable circumſtance, that, although near four hundred years poſterior to Theophraſtus, and profeſſedly a collector, Dioſcorides has not been able to enumerate above ſix hundred plants, five hundred of which were deſcribed or mentioned by the Father of Botany. In the writings of Dioſcorides we do not recognize that elegance of diction and thoſe graces of manner which characterize his predeceſſor. His ſtyle is ſimple, plain and devoid of ornament. The deſcriptions, nevertheleſs, although imperfect, are preferable to thoſe of the other, becauſe the characters which they collect are more numerous and invariable. Plants were arranged, by this author, from their uſes in medicine and domeſtic œconomy, into four claſſes, which are thus deſigned; Aromatics, Alimentary Vege-

Vegetables, or ſuch as ſerve for food; Medicinal and Vinous Plants. To obſerve on the impropriety of ſuch a mode of arrangement, is altogether unneceſſary. In fact, the qualities and virtues of plants can never afford genuine diſtinctive marks, becauſe neither fixed and invariable, nor impreſſed in legible characters upon the bodies themſelves. The different parts too of a plant often poſſeſs different and even oppoſite virtues; ſo that, ſuppoſing ſuch virtues to be known, and to be miſapplied to the purpoſe of vegetable arrangement, the root muſt frequently fall under one diviſion, the leaf under a ſecond, the flower and fruit under a third. Beſides, if we reflect that the ſole end of ſuch arrangement is to facilitate to others the knowledge of plants, the inſufficiency and even abſurdity of methods founded upon their virtues will quickly appear. A ſtalk of vervain is preſented to me, which I am to inveſtigate by a method that has the virtues of plants for its principle. How am I to proceed? Before I can ſettle the claſs under which it is arranged, I muſt diſcover its virtue; and ſuch diſcovery being the reſult of repeated experiments on various parts of the human body, may require years for its accompliſhment. Thus ſuch methods of diſtribution are totally uſeleſs in inveſtigating plants, and therefore highly improper to be employed. A genuine diſtinctive character founded on the external parts, which a little inſtruction ſoon renders familiar, will cut ſhort this work of years, and determine almoſt at ſight the claſs, genus and ſpecies of the plant in queſtion. In the firſt caſe there is no principle whatever upon which to proceed; in the ſecond the ground is ſure, becauſe the external parts are always preſent, and always obvious to ſight. The ſtructure of the root, ſtem, leaves, flower and fruit, is an object of ſight, and can always be recognized: the virtues and medicinal powers of plants afford no diſtinctive character, and cannot be recognized without a ſeries of experiments made expreſsly with that view.

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It deſerves likewiſe to be remarked, that the virtues of plants employed in medicine have been much better aſcertained ſince the introduction of genuine ſyſtematic arrangements than at any former period: and it is more than probable that the nearer we approach the order of nature, with greater certainty and facility ſhall thoſe virtues be detected. The powers and ſenſible qualities of a ſingle plant of any of the natural families being diſcovered, thoſe of the reſt no longer remain concealed; as ſo many circumſtances of reſemblance in the external ſtructure may well induce ſomething more than conjecture that their qualities and effects upon the human body cannot be very diſſimilar. And, indeed, it is its extreme importance to phyſic, that renders the diſcovery of a natural method in Botany, ſo deſirable an object: conſidered merely as an arrangement, whoſe chief object is to facilitate the knowledge of plants, it muſt yield the preference to many of the artificial methods already known. This is demonſtrated at large in the preceding ſection.

THE ſame cauſes which render methods founded on the virtues of plants, unfavourable for the purpoſe of inveſtigation, muſt evidently diſqualify all their other variable qualities and accidents from holding a place in a genuine diſtinctive ſyſtematic arrangement, The *natale ſolum* of plants, which is one of Theophraſtus's diviſions, affords no more a diſtinctive character than their powers and virtues. Many countries, as well as many ſoils, produce the ſame individual plants. The ſame ſpecies which crown the mountains, frequently cover the fens: and plants which have long been reckoned the peculiar inhabitants of ſome parts of Aſia and America, are now found to grow naturally in equal perfection in the very different climates of Lapland and Siberia. In fine, however uſeful the natural ſoil and climate of plants may

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be in gardening, they are circumſtances of no utility whatever, when employed as the foundation of a mode of arrangement.

The ſize of plants, which ſuggeſted the ancient diviſion into trees and ſhrubs, is no leſs an equivocal mark of diſtinction than the circumſtances already mentioned. The vine, which modern botaniſts denominate a ſhrub, was ranged by Theophraſtus in his third claſs, containing trees. In fact, every thing reſpecting ſize is ſo much affected by differences of ſoil, climate and culture, that the ſame plant, in different circumſtances, ſhall differ exceedingly in height, and, in a method founded upon that accident, be arranged ſometimes as a tree, ſometimes as a ſhrub, and ſometimes even as an under-ſhrub, according as it exceeds, equals, or falls ſhort of a given ſtandard.

No leſs inſufficient and deſpicable are characteriſtical marks drawn from the ſenſible qualities of plants; I mean their colour, taſte and ſmell.

Of all the attributes of vegetable nature, colour is perhaps the moſt inconſtant. Heat, climate, culture, ſoil, and a thouſand circumſtances contribute to produce almoſt endleſs diverſities in that quality, and render the tranſition from one colour to another natural and eaſy. Red and blue paſs eaſily into white; white into purple; yellow into white; red into blue; blue into yellow. In the ſame leaf or flower are frequently obſerved ſeveral different colours. Variations too in point of colour are often found to take place, not only in different individuals of the ſame ſpecies, but likewiſe in ſimilar parts of the ſame individual plant. Marvel of Peru and Sweet William produce flowers of different colour upon the ſame ſtalk.

OBJECTIONS equally valid lie againſt taſte and ſmell. The former varies in different individuals from differences of age; and even in the ſame individual, at different times, according to the morbid or ſound ſtate of the organ. The latter is different in different ſubjects, and varies in each. The effluvia ſent forth from the ſame body are not always of equal intenſity; which is the reaſon that dogs diſcover their maſters in a crowd with much greater facility at one time than another. In plants, taſte is ſubjected to continual variations from differences of climate, ſoil, and culture. Garlic, in ſome climates, particularly in Greece, is ſaid to loſe its rankneſs; apples and pears that grow naturally in the woods are intolerably acid; celery and lettuce, which culture renders ſweet and palatable, are, in their wild uncultivated ſtate, bitter, diſagreeable, and, in ſome caſes, noxious.

ALMOST cotemporary with Dioſcorides flouriſhed Antonius Muſa, Cato, Varro, Virgil, and Columella; the firſt, author of a treatiſe ſtill extant on the plant betony; the four others celebrated for their uſeful tracts on agriculture and the œconomy of rural affairs.

PLINY the elder, who is generally reckoned poſterior to Dioſcorides, ſcarce merits a place in a review of this kind. His work, entitled a Hiſtory of the World, is a compilation from the writings of all his predeceſſors in every branch of natural knowledge. The botanical part of this voluminous undertaking is included in fifteen books, which, beſides the plants of Theophraſtus and Dioſcorides, contain deſcriptions of ſeveral new ſpecies, extracted, in all probability, from works which would have been totally loſt, but for the laudable induſtry of this indefatigable compiler. Pliny uſes ſcarce any mode of arrangement, ſave the very incorrect, though ancient, diſtinction into trees,

ſhrubs and herbs. His ſubjects are exceedingly multifarious, and extend, not merely to botanical diſtinctions, but to gardening, agriculture, and whatever is connected either more nearly or remotely with the ſcience of plants. In an immenſe compilation of this kind from authors of very different merit and credibility, we are not to be ſurprized, if all the facts are not equally authentic, nay, if ſome are abſolutely contradictory. Upon the whole, Pliny, although no botaniſt, is a valuable and uſeful writer. His book contains all the natural hiſtory of the ancients delivered in a ſtile that is not devoid of ornament: and the botanical part, however badly arranged, gives deſcriptions or names of upwards of a thouſand ſpecies of plants: ſo that about four hundred ſpecies are mentioned by Pliny which are not to be found in the writings of Dioſcorides; an increaſe which ſeems amazing, when it is conſidered, that the interval betwixt the Greek and the Roman could not have exceeded thirty years.

As it is the profeſſed deſign of this ſection to relate the hiſtory, not of botaniſts, but of botanical methods, I paſs over with a bare mention the names of ſome Romans and Aſiatic Greeks, whom I find recorded in this æra of the ſcience as perſons addicted to the ſtudy of plants, but totally inattentive to the laws of vegetable arrangement. In this light we are to regard the writings of Rufus under Trajan, and thoſe of Palladius under the emperor Antonius Pius. About the middle of the ſecond century appeared Galen, a name not more celebrated in phyſic than inſignificant in Botany. The virtues and medicinal powers of bodies, whether animal, vegetable or mineral, were the favourite reſearch of this author. To this great object he rendered every thing ſubſervient, regarding as uſeleſs whatever was not profeſſedly calculated to promote that end. Thus the Botany of Galen, however uſeful to the ſtudent of Pharmacy, is inſufficient

for

for inveſtigating a ſingle plant. It ſuppoſes every thing, it teaches nothing. Oribaſius, another Aſiatic Greek, trod in the path marked out for him by his maſter Galen, but with ſo little ſucceſs, that ſcarce a fourth part of the plants of Pliny was known to this author. To him ſucceeded Aetius Amydenus, Paulus Ægineta, and Alexander Trallian: the two firſt compilers; the latter a man of a more free and liberal turn: but the ſcience was in diſrepute, and not even a Trallian could revive its drooping head.

THE limited Botany of the ancients, and its rapid decline from the time of Pliny to that of the authors juſt mentioned, can only be attributed to a neglect of ſyſtematic arrangement, which, in facilitating the knowledge of plants, prepares for an inveſtigation of their powers and virtues. It was not till near the cloſe of the eighth century, that the Cimmerian darkneſs which had diffuſed itſelf over this ſcience began to diſſipate, and Botany, as well as the other departments of natural knowledge, re-aſſumed its priſtine form. The ſcene of this firſt reſtoration of the ancient Botany, lies in Arabia. Serapio, a well-known name in medicine, ſtands firſt in the Arabian catalogue; to him ſucceeded Razis, the laborious Avicenna, Averrhoës, Actuarius and other names leſs celebrated. Their works, however, are only tranſlations and compilations from the Greek writers. The genuine ſpirit of arrangement had not yet obtained. Unable therefore to ſupport itſelf long, the ſcience ſunk into a ſecond oblivion; and the few faint glimmerings which chance had juſt afforded, ſerved only to make the ſubſequent darkneſs appear more horrible.

DURING the ages emphatically ſtiled Barbarous, the human mind may be ſaid to have ſuffered a ſort of temporary annihila-

tion. Literature languiſhed. Science was no more. In this ſtate of univerſal torpor, not to be paralleled in the hiſtory of mankind, Botany, we may well ſuppoſe, ſhared the general fate, and lay neglected with every other uſeful art. For four hundred years poſterior to Abenguefit, an Arabian phyſician who flouriſhed in the latter end of the twelfth century, ſcarce any attempts were made to draw from its obſcurity the Botany of the ancients, far leſs to extend its boundaries, by new reſearches. True it is, the hiſtory of the ſcience commemorates the names of a Myrepſus, a Hildegardis, a Quiricius, a Platearius and a Sylvaticus, who, during the prevalence of barbariſm, made ſome faint efforts to emerge from the general ignorance: but, unequal to the arduous taſk, they ſunk under the mighty load; and the ſame obſcurity has involved them and their works. Little more reverence is due to the names of Cuba, De Dondis, Suardus, Boſco, Villa Nova, and Creſcentius, who lived in the fourteenth and fifteenth centuries, and are generally ranked among the number of botanical writers. They wrote of plants indeed; but they wrote of them without method, without language, without knowledge. All was one great chaos; and conſummate indeed would have been the labour of that man who could reduce ſuch a maſs of confuſion into ſymmetry and order.

On the revival of letters in the beginning of the ſixteenth century, the Botany of the ancients was reſtored a ſecond time. The Greek writings were tranſlated into Latin, the common language of Europe; and the ſpirit of free enquiry once more prevailed. Gaza, a Greek refugee at Rome, made elegant tranſlations of Ariſtotle and Theophraſtus, who, in the ſequel, were commented on by Scaliger and Stapel. Dioſcorides was tranſlated, firſt by Cornarus in 1557, and afterwards by Sarrazin in 1598. His beſt commentators are Hermolaus Barbarus, Fuchſius,

ſius, Ruellius an ingenious Frenchman, Cordus, Geſner, and Matthiolus. The moſt diſtinguiſhed commentators of Pliny are, Dalechamp in 1604, Saumaiſe or Salmaſius in 1689; Harduin and Guilandinus. Meurſius and Urſinus have written commentaries upon Cato; Campegius and Monardes upon Meſue the Arabian, and Lonicer upon Avicenna, who has been tranſlated by ſeveral writers, particularly Alpagus, Coſtæus, Plempius, into Latin; and by one writer, Amalthæus, into Hebrew.

HIERONYMUS Bock, or Bouc, a German, generally known by the name of Tragus, is the firſt of the moderns who has given a methodical diſtribution of vegetables. In his Hiſtory of Plants, publiſhed in 1532, he divides the 800 ſpecies there deſcribed into three claſſes, founded on the qualities of vegetables, their habit, figure and ſize. The diſtinctions of Lonicer, Dodonæus, L'Obel, Cluſius, Brunfelſius, Monardes, Cordus and ſome other Botaniſts of this period were not more ſcientifical, and reſpected either the medicinal powers of plants, their ſenſible qualities, œconomical uſes, or ſome of the external parts not connected with the flower and fruit. The inſufficiency of leading characters from the virtues, accidents and variable qualities of plants has been fully demonſtrated in the preceding part of this ſection. A certain degree of excellence is poſſeſſed by every method, which derives its diſtinctive characters from any of the external parts: but that excellence is merely comparative, being, in different methods, greater or leſs, as the parts, by their ſtructure and modifications, ſeem more or leſs adapted for the purpoſe of vegetable arrangement. Characteriſtical marks drawn from the root, ſtem or leaves, are ſuperior to thoſe derived from the virtues and qualities of plants, becauſe obvious to ſight, and capable of being recognized in the bodies themſelves. But characters drawn from the flower and fruit being more uniform and invariable, and there-

therefore of far greater utility in facilitating the knowledge of plants, are ſuperior, in point of excellence, to thoſe derived from the other parts.

THE roots and ſtems of plants do not furniſh ſufficient variety of characters to ſerve as foundations of a mode of arrangement. Botaniſts have been able to diſtinguiſh but three ſorts of roots, *fibrous*, *tuberous*, *bulbous*, and their modifications. With ſo few diſtinctive characters, what method could be uſeful? For although by means of ſuch diſtinctions alone the claſs of any plant can be immediately detected, it is next to impoſſible that the genus ever ſhould: Why? becauſe the claſſes, for want of diſtinctive characters, being few in number, would be ſo overloaded with genera, that a combination of all the parts of the plant, and their ſeveral modifications would not ſuffice to diſcriminate them. It deſerves likewiſe to be remarked, that the root, by being hid under ground, ſeems of all the external parts, the moſt improper for the purpoſe of vegetable arrangement. What could be more inconſiderate than to make our knowledge of any plant depend upon a circumſtance which muſt always injure, and, in many caſes effectually deſtroy it? The trouble too of pulling up plants by the root in order to determine their preciſe place in the arrangement, muſt have proved extremely irkſome to the botaniſt, and well nigh compelled him to relinquiſh a ſcience, ſo difficult in the attainment. For theſe reaſons, no method that I am acquainted with, claims the roots of plants, and their different modifications for its ſole principle: I ſay its ſole principle, becauſe there are ſome methods, and thoſe ſince the introduction of ſyſtematic arrangements, in which the form of the root is made a characteriſtic diſtinction for diſcriminating a few of the claſſes only. Equally improper for the purpoſe of arrangement, becauſe not more numerous, are the forms and modifications of the ſtem. In

trees,

trees, it is hard and woody; in herbs, ſucculent; in the graſſes, hollow and jointed; in the ferns and palms, a ramified leaf, or rather a ſingular compoſition of a leaf and branch. Theſe are almoſt the only diſtinctions ariſing from the form of the ſtem: unleſs we add, that its figure, generally cylindrical, is, in ſome plants, angular; and that, in others, it is found to elevate the flower and fruit only, without the leaves.

The duration of the ſtems of plants ſuggeſted the ancient diſtinction into herbs and trees; the former, vegetables of a leſs ſolid conſiſtence, which loſe their ſtems during the winter; the latter of a firm, ſolid texture, woody, and ſubſiſt, by their ſtems, during the winter. Theſe laſt were ſubdivided by Ariſtotle and Theophraſtus, and afterwards by Cluſius in 1576, into Trees properly ſo called, Shrubs and Under-ſhrubs. Under-ſhrubs are defined to be perennial plants with a woody durable ſtem, whoſe height exceeds not that of herbaceous vegetables. Shrubs differ from theſe only in their ſuperior ſize. Trees properly ſo called are perennial woody plants, which riſe to a very great height, and ſubſiſt for many years. Such is the diſtinction of L'Ecluſe; but it is far from being accurate, and, conſidered as the foundation of a mode of arrangement, has been proved inſufficient. Neither are thoſe to be regarded, who, in order to diſcriminate woody plants, have recourſe to the number of ſtems, combined with their ſize, and underſtand by trees, all ſuch vegetables as are of great height, and riſe with a ſingle ſtem; by ſhrubs, ſuch as riſe with ſeveral ſtems; and by under-ſhrubs, ſuch as have only a ſingle ſtem, that riſes to a very ſmall height. The character aſcribed by ſuch authors to ſhrubs falls oftener to the ſhare of thoſe plants denominated under-ſhrubs; for although ſhrubby plants ramify and divide much nearer the ground than trees, yet are they very rarely known to proceed from the roots with more than

a ſingle

a ſingle ſtem. Linnæus has not been more ſucceſsful with his diſtinction from the buds: for if by trees we were to underſtand ſuch woody plants as riſe with buds; and by ſhrubs, ſuch as have no buds, the very large trees of India, which rarely bear any gems, would, notwithſtanding their great height, be denominated ſhrubs, and arranged accordingly. The truth is, that nature ſeems to have put no abſolute limits between trees and ſhrubs; ſo that a definition cannot be given of the one, which ſhall not, in ſome ſort, include the other. Thus, trees, ſhrubs, under-ſhrubs and herbs form a kind of ſcale, the degrees of which, like thoſe of the ſcale of beings imagined by ſome Naturaliſts, run inſenſibly into each other, and elude diſtinction. It is only, however, in the mean terms of this ſeries that we are to expect any ſuch inſenſible gradations. The extremes are perfectly diſtinct, and can never be confounded. But though I allow the diſtinction of herbs and trees to be ſufficiently aſcertained, I am far from thinking it proper to be employed as a diſcriminating claſſical character. If uſed alone, it is too general to be of any ſervice whatever: if in conjunction with other characters, it deſtroys the uniformity of the method. In the former caſe, the number of claſſes is reduced to two; in the latter, there is an unneceſſary multiplication of claſſes, becauſe the ſame characters which diſcriminate herbs, ſerve frequently to diſcriminate trees alſo. M. Tournefort, by adopting this diſtinction, has deſtroyed the uniformity of his plan, and ſpun out into twenty-two claſſes what, without ſuch diſtinction, might have eaſily been comprized in ſeventeen. Want of uniformity, however, aſide, there are other reaſons which render the duration of plants an inſufficient and improper diſtinction. In many caſes, we cannot determine at ſight whether a particular plant is of the herbaceous or woody kind; in the ſame manner as the ſize of plants, allowing it to be a ſufficient character, could never diſtinguiſh trees from ſhrubs, till each had

had attained its full and proper height. Young trees and ſhrubs are not leſs tender and ſucculent than herbs; ſo that an entire revolution of the ſeaſons muſt frequently elapſe before we can be apprized of their genuine nature. On the other hand, many herbaceous plants appear of a hard, ſolid conſiſtence like ſhrubs; and to mention no more, there are inſtances of plants which, from being trees in a warm climate, have become herbs, by being removed into a cold one.

As the duration of the ſtem ſerves to diſcriminate trees from herbs, the duration of the root diſtinguiſhes the ſeveral kinds of herbaceous vegetables from one another. Herbs which riſe, grow and die in one year, are termed Annuals; thoſe which perform the changes of vegetation twice, Biennials; and thoſe which ſubſiſt ſeveral years by the root, Perennials. Trees and ſhrubs differ from perennial herbs in that they ſubſiſt both by the root and ſtem.

The leaves, although much more diverſified in their form than either the root or ſtem, are equally improper for diſcriminating the claſſes of plants. Saſſafras, and paper-bearing mulberry bear leaves, ſome of which are perfectly entire, others cut either ſlightly or deeply into one, two or three lobes. In triple-thorned Acacia the leaves are partly winged, partly double-winged, partly ſimple. Innumerable are the accidents which produce varieties in the form and ſituation of leaves, and render ſuch circumſtances highly improper to be employed as ſcientific diſtinctions. The ſame plant, in different climates, with different culture, or ſowed at different ſeaſons of the year, is covered with leaves that are totally diſſimilar. Plants, otherwiſe nearly related, are found to produce leaves, between which there is no ſort of reſemblance; and others which differ eſſentially in figure, qualities and habit,

bear leaves ſo remarkably ſimilar, that confuſion would be unavoidable, if primary diviſions were to be erected upon ſo unſtable a foundation. Neither is the ſituation of leaves, I mean their diſpoſition on the ſtem and branches, however comparatively fixed, abſolutely immutable. In a ſpecies of looſe-ſtrife, the leaves, which generally ſtand oppoſite in pairs, are occaſionally produced by threes, fours and fives round the ſtem. An addition of the like kind is frequently made to the number of partial or leſſer leaves, which conſtitute a compound leaf. In a ſpecies of trefoil, the leſſer leaves in queſtion, generally three in number, are occaſionally augmented to four.

The root, ſtem and leaves being thus found ſingly inſufficient, leading characters were ſought in a combination of thoſe and the other eſſential parts of vegetation. This combination, denominated the port or habit, has been no more ſucceſsful, as the foundation of an arrangement, than the circumſtances already mentioned. In detecting the order of nature, ſuch a combination muſt undoubtedly be employed: in arranging plants with a view to facilitate their knowledge, it is highly improper, becauſe complicated, and deſtructive of uniformity. In fine, characters drawn from the habit or general appearance, however uſeful in diſtinguiſhing genera and ſpecies, are, in my opinion, never to be employed as claſſical diſtinctions.

Such was the progreſs of botanical method, when Conrad Geſner turned his eye to the flower and fruit, and ſuggeſted the firſt idea of a ſyſtematic arrangement. This ingenious Naturaliſt, who imbibed his knowledge of plants in the mountains of Switzerland, was early ſenſible of the impropriety of every plan of arrangement which had been adopted. The claſſical characters of each method underwent a particular review: and all, from

defects

defects peculiar to each, were found liable to cenſure. In this comparative trial of the aptneſs of the ſeveral external parts for the purpoſe of arrangement, it appeared wonderful to Geſner that none of the numerous writers on plants had availed themſelves of the parts of fructification, which, from their great variety, ſuperior conſtancy, and extreme importance in perpetuating the ſpecies, ſeemed to merit the preference above every other claſſical diſtinction. That Geſner knew the doctrine of the ſexes, which ſuppoſes the moſt intimate connection between the flower and fruit, I do not pretend to affirm: but he certainly knew that the fruit was uſeful in re-producing the plant, and that it always ſucceeded the flower. Thus a connection, if not ſo intimate, at leaſt, as indiſſoluble, was eſtabliſhed; and the parts of the flower and fruit were named in conjunction. By the flower was underſtood that fine, ornamental and beautifully coloured part of the plant, which falls off or withers ſoon after its expanſion, and immediately precedes the fruit, to which it generally adheres. This definition, although it principally reſpects the petals or coloured leaves, includes likewiſe the calix or flower-cup; the ſtamina, chives or threads; and the piſtil or pointal-parts which, in the infancy of ſyſtem, were not deemed of ſufficient importance to merit much attention, nor even to be all of them diſtinguiſhed by particular names. By the fruit was meant that annual part of every vegetable, which coheres, and is poſterior, to the flower, and, having attained maturity, lodges itſelf ſpontaneouſly in the ſoil, whence, when properly nurſed, it emerges an infant plant, in every reſpect ſimilar to its parent-vegetable. In this definition were manifeſtly included both the ſeed-veſſel, vulgarly called the fruit, and the ſeeds, which are its eſſence.

It was in 1560 that Geſner, thoroughly convinced of their ſufficiency, propoſed to the world his idea of an arrangement

from the parts of the flower and fruit. No plan, however, was eſtabliſhed by Geſner upon this principle; the idea was ſuggeſted, but the application left to be made by others; and it was not till 1583, that Dr. Andrew Cæſalpinus, a phyſician of Piſa, and afterwards profeſſor of Botany at Padua, availing himſelf of the ingenuity of his predeceſſor, propoſed a method which has the fruit for its baſis; and thus gave origin to ſyſtematic Botany, the ſecond grand æra of the hiſtory of the ſcience.

In propoſing the parts of fructification as the propereſt for arranging plants, Geſner communicated no hints reſpecting the choice that was to be made of ſome of thoſe parts in preference to others. Each particular organ of the flower and fruit furniſhes ſufficient variety to ſerve as foundation of a method: yet all are not equally proper for that purpoſe. The firſt ſyſtematic writers made choice of the fruit, as being the moſt eſſential part of vegetation. Unaccuſtomed to examine the ſubject with that philoſophical minuteneſs which characterizes the botaniſts of theſe days, they were not aware, that the figure of the fruit is always more liable to change than that of the flower; and that this laſt being prior to the other, and appearing at a time the moſt proper for botanical reſearches, ſeemed pointed out by nature as peculiarly adapted for furniſhing claſſical diſtinctions. In ſummer, when plants are in their higheſt perfection, and the blooming face of nature invites to theſe innocent and pleaſing enquiries, the man who would attain a knowledge of vegetables, muſt not think of deriving it from a method founded on the fruit. Such a method will prove an unſurmountable obſtacle in his way: the ſeaſon invites in vain; in vain does inclination lend her powerful aſſiſtance; he cannot advance a ſingle ſtep; he becomes chagrined, judges the undertaking impracticable, and abandons it in diſguſt.

THE parts of the flower having been frequently employed by the firſt ſyſtematic writers, as ſubaltern diſtinctions, in diſcriminating orders and genera, it is evident that the plant to be explored could often not be referred to its proper genus and ſpecies for months after the inveſtigation of its claſs. Suppoſe a plant ripens its fruit in October, and does not produce flowers till the following May, the claſs, upon inſpection of the fruit, is immediately aſcertained, but the plant ſtill remains unknown, and will continue ſo for upwards of ſix months after, if the characters of the order or genus have been made to depend on any part of the flower. In ſome methods founded on the flower, no inconvenience of this kind can exiſt. The claſs is always determined by that part of the flower which furniſhes the leading character of the method: the orders and genera, which come next to be aſcertained, frequently borrow their diſtinctive marks from other parts of the flower; and if, as ſometimes happens, the fruit is made a ſubaltern diſtinction, it is generally ſo combined with ſome characteriſtic of the flower, that the genus can, in moſt caſes, be explored with the ſame facility as the claſs: I ſay generally, becauſe in the methods in queſtion, there are inſtances of generical characters founded ſolely on the fruit; but beſides that ſuch inſtances are exceedingly rare, they ſtand vindicated from this conſideration, that the progreſſion from the flower to the fruit, is much more natural than that from the fruit to the flower.

METHODS founded on the fruit have another inconvenience, and that not ſufficiently attended to. Plants conſtantly ripen their fruit in thoſe countries where they are native: But do all plants without exception poſſeſs the ſame faculty in every country to which they may accidentally be tranſported? The fact is otherwiſe. Many plants that are natives of a very warm climate, neither ripen nor form fruit, upon being removed into a cold one.

Few

Few of the African, Aſiatic and Weſt-Indian plants produce fruit in England. A method therefore founded upon the fruit could only facilitate the knowledge of ſuch plants to the inhabitants of the ſeveral countries where they naturally grow. To the Engliſh botaniſt it could afford ſcarce any aſſiſtance. The ſame objection cannot, with reaſon, be urged againſt methods founded on the flower; ſince the influence of climates much colder than that of England has not been able to deſtroy the faculty of producing flowers in many, perhaps moſt of the plants that were juſt mentioned. Neither is the preſence of the fruit ſo neceſſary a circumſtance in ſome methods which have the parts of the flower for their baſis, as in thoſe of the firſt ſyſtematic writers. In the former, as we have ſaid, the generical character ſeldom depending on the fruit alone, the plant in queſtion may, in moſt caſes, be explored without its aſſiſtance: in the latter, the claſs cannot be aſcertained in abſence of the fruit: and if the claſs is not known, it is impoſſible that the genus ever ſhould.

HAVING ſaid ſo much in favour of methods founded upon the flower, I ſhould be inexcuſably partial not to mention a very ſtriking inconvenience of which they have been productive. The parts of the flower engroſs the ſole attention of modern botaniſts. Thoſe of the fruit are almoſt totally neglected. Nothing can be more prepoſterous or abſurd. For without enquiring, with Linnæus, whether the powder incloſed in the tops of the ſtamina is of ſufficient importance to the plant to juſtify our minuteſt reſearches into that organ, the ſeed-veſſel and ſeeds are confeſſedly organs of, at leaſt, equal importance, and therefore entitled to an equal ſhare of attention. True, the parts of the flower conduct with greater facility to the knowledge of plants; and, on that account, merit attention as the main agents of vegetable arrangement: but the parts of the fruit are no leſs deſerving

ſerving our regard, from their own intrinſic worth, their confeſſed importance in vegetation, and agency in perpetuating the ſpecies.

For theſe reaſons, the firſt ſyſtematic writers attached themſelves to the fruit, in preference to the flower; and it was not till upwards of a century after Cæſalpinus, the Father of Syſtem, that Rivinus, profeſſor at Leipſic, ſenſible of the difficulties which his predeceſſors had encountered, and deſirous to avoid them, produced another revolution in the ſcience, by propoſing a method founded on the regularity and number of the petals. We are not, however, to ſuppoſe that, in this long interval, claſſical diſtinctions were ſolely furniſhed by the parts of the fruit. Characters drawn from the habit or general appearance of plants ſtill maintained their conſequence; and theſe combined with ſome of the external parts more or leſs connected with fructification, ſerved effectually to deſtroy the uniformity of the methods into which they entered. In fact, Syſtem did not all at once attain that degree of purity and perfection to which it has now arrived. It was long debaſed by an alloy of the groſſeſt kind, which time, and time only, could expel. That alloy is now no more; the rubbiſh which choaked up the avenues to the ſcience is removed; its luxuriances are ſkilfully pruned; and Syſtem has reached its ultimatum of perfection.

Cæsalpinus ſets out with the ancient diſtinction of vegetables from their duration into trees and herbs. With the former he combines ſhrubs; with the latter, under-ſhrubs. Trees, the firſt grand diviſion, are diſtributed into two claſſes, from an attention to the ſituation of the radicle or principle of life in the ſeed. In ſome trees, as the oak, elm, beach, walnut, aſh, olive, ſumach and cherry, the radicle is ſeated in the *apex* or ſummit

of

of the ſeed: in others, as the fig, mulberry, holly, roſe, medlar, apple, tamarind, pine, fir, cypreſs and juniper, its place is in the baſe. The ſame beautiful diſtinction is frequently uſed by this author as a ſecondary character in diſcriminating the ſections or orders of herbaceous plants. In the ſecond grand diviſion, containing under-ſhrubs and herbs, are thirteen claſſes conſtituted from the number of ſeeds, ſeed-veſſels and their cavities or internal diviſions. Some plants have only a ſingle ſeed, as valerian, nettle, hemp, dock and the graſſes. Theſe conſtitute the third claſs in Cæſalpinus's method. The fourth conſiſts of herbs with an undivided ſeed-veſſel of the apple and berry kind, containing ſeveral ſeeds; and is exemplified in cucumber, briony, honeyſuckle, deadly night-ſhade, and herb-chriſtopher. The plants of the fifth claſs agree with the former in having ſeveral ſeeds contained within an undivided caſe or ſeed-veſſel, but differ in the nature of that veſſel, which, in the claſs in queſtion, is dry, and of the capſule and pod kind. Pink, primroſe, ſwallow-wort and the pea-bloom or butterfly-ſhaped flowers furniſh examples. Theſe three claſſes exhauſt what Cæſalpinus terms his *ſingle principle* of diſtribution; the ſeeds being either ſingle, or contained in a veſſel with a ſingle cavity. In the claſſes which follow, the number of ſeeds, caſes or cells is two, three, four or many. The ſixth claſs contains all the umbelliferous plants, which have two naked ſeeds; the ſeventh, ſuch plants as have a double receptacle for the ſeeds, that is, a ſeed-veſſel divided into two cells. It is exemplified in madder, mercury, ſpeedwell and moſt of the croſs-ſhaped flowers. In the two following claſſes, the plants have a triple receptacle for the ſeeds, in other words, a ſeed-veſſel divided internally into three cavities or cells: but appearing too numerous to be arranged in one claſs, Cæſalpinus has, very unſyſtematically, borrowed diſtinctions from the roots, and diſtributed them into two claſſes, one of which contains fibrous, the other bulbous-

rooted

rooted plants. The former, which is the eighth claſs, is exemplified in convolvulus, violet and St. John's wort; the latter in hyacinth, tulip, lilly, narciſſus, and the other well-known liliaceous bulbous-rooted plants. The tenth claſs ſtands ſolitary, and conſiſts of plants which have four naked ſeeds. Bugloſs, lungwort, comfrey, hound's tongue, ſage, germander, roſemary, and the other lip-flowers furniſh examples. The principle of diſtribution in the four following claſſes is the ſame. In the eleventh, twelfth and thirteenth, the flowers are ſucceeded by a number of naked ſeeds: in the fourteenth, the ſeeds are numerous, but contained either in ſeveral capſules, or in one capſule that is divided internally into ſeveral cells. The two firſt-mentioned claſſes contain all the compound flowers; the thirteenth conſiſts of ſuch ſimple flowers as have many naked ſeeds, and is exemplified in ranunculus, adonis, virgin's bower, herb-bennet and cinquefoil. The reader will naturally aſk how theſe three claſſes are to be diſtinguiſhed from each other in a method which has not the parts of the flower for its baſis. By this certain rule, that in the thirteenth claſs, the flower is common to all the ſeeds; whereas in the two preceding claſſes, each ſeed has its own proper floret, or, as Cæſalpinus expreſſes it, the flower is diſtributed by parts on the top of each ſeed. The compound flowers arrange themſelves into two claſſes from the different ſituation of the radicle or heart of the ſeed, which in ſome is placed towards the middle, and in others towards the baſe. The former conſtitute the eleventh claſs of this method, and correſpond to the radiated flowers of later botaniſts: the latter, the twelfth, and include compound flowers whoſe florets are either all flat, or all hollow; ſuch are lettuce, nipple-wort, dandelion, hawk-weed, centaury, ſaw-wort and thiſtle. The thirteenth and fourteenth claſſes have already been illuſtrated: this laſt is exemplified in columbine, hellebore, houſe-leek, navel-wort, poppy, water-lilly, birth-wort and aza-

lea; the four firſt of which have ſeveral capſules; the four laſt a ſingle capſule with ſeveral internal diviſions or cells. It only remains to characterize the fifteenth claſs, which ſerves as an appendix to the method, and conſiſts of plants that have neither flower nor fruit. The ferns, flags, moſſes and muſhrooms, which, from our imperfect knowledge of their ſtructure, form a ſimilar diviſion in every method, conſtitute the concluding claſs in that of Cæſalpinus.

Such are the outlines of the firſt attempt towards a genuine ſyſtematic arrangement. To form a proper eſtimate of its merits or defects, we muſt previouſly aſcertain the facility or difficulty with which it conducts to the knowledge of plants: and this we can in no way ſo certainly determine as by recurring to particular inſtances. A carnation is preſented to me, which I am to refer to its proper claſs in Cæſalpinus's arrangement. Is the plant in flower? I am immediately at a ſtand: it can never be reduced to its claſs in that ſtage of vegetation. It muſt have ceaſed to flower; it muſt have ripened, or, at leaſt, have begun to form, its ſeed-veſſel or ſeeds. This preliminary adjuſted, my firſt enquiry is, to which of the two grand diviſions does the plant in queſtion belong? In other words, is it a tree, or an herb? To ſolve this query, I may frequently be obliged to wait for ſeveral months; becauſe the anſwer to it is principally regulated by the duration of the ſtem. Behold me then at a ſtand a ſecond time. I know it will be ſaid that this is an exaggerated repreſentation; that I paint imaginary difficulties; and that he muſt be a novice indeed, who, in ſuch circumſtances, cannot diſtinguiſh at ſight a tree from an herb. I grant it; he would be a novice; but let it be remembered that the ſole intention of arrangement is to facilitate the knowledge of plants: the learned need no ſuch auxiliary; it is the novice only that requires it: and that ſyſtem is undoubt-

undoubtedly the moſt excellent, which beſt accommodates itſelf to the wants of the mereſt novice—an axiom which, although ſelf-evident, has been ſo little regarded, that the diſtinction into herbs and trees was ſucceſſively adopted by every ſucceeding writer to the time of Rivinus, by whom it was very properly rejected as uncertain, and unconnected with fructification. To return to my plant. Having no certain criterion of the juſtneſs of my determination, I muſt have recourſe to conjecture, a dangerous interloper in ſcience, which much oftener conducts to error than truth. Suppoſing, however, that I am fortunate enough to gueſs right, and refer the plant in queſtion to that diviſion of the method which contains herbaceous vegetables: how am I next to proceed? By the determination juſt given, two claſſes are entirely cut off; thoſe, to wit, containing trees and ſhrubs: and I have to ſeek for my plant among the thirteen claſſes which remain. The preſence of the fruit implying the previous exiſtence of the flower, ſerves effectually to exclude it from the fifteenth claſs which conſiſts of plants that have neither flower nor fruit. I now examine the fruit particularly, and diſcover it to be a ſingle undivided capſule containing numerous ſeeds. My plant then cannot belong to the third claſs, the character of which is a ſingle ſeed; nor to the fourteenth, becauſe although the plants pertaining to it bear numerous ſeeds, they are contained either in more capſules than one, or in a ſingle capſule with ſeveral cells. Its pretenſions to a place in the eleventh, twelfth and thirteenth claſſes are equally ill-founded, becauſe in theſe, the ſeeds, though numerous, are naked, that is, have no capſule or caſe. In the tenth claſs, the number four; in the eighth and ninth, the number three; and in the ſixth and ſeventh, the number two, predominates; but neither two, three nor four, predominates in the fruit in queſtion: and therefore the plant cannot be referred to any of theſe claſſes. There remain

only the fourth and fifth claſſes, to one or other of which the plant in queſtion muſt belong. Theſe two claſſes differ only in the nature of the ſeed-veſſel, which, in the former, is pulpy, in the latter, dry. But the plant to be explored has a ſeed-veſſel that is dry, not pulpy; and is therefore to be referred to the fifth claſs, the plants of which have numerous ſeeds contained in a ſingle undivided capſule.

In this manner are plants referred to their proper claſs in Cæſalpinus's method, though not all with equal facility. There are ſome even which, poſſeſſing the characters of two diviſions, arrange themſelves indifferently under either. Swallow-wort is referred by the author to the fifth claſs, although its double ſeed-veſſel ſeemed to give it an equal title with the pæony to a place in the fourteenth. Defects of another, though not groſſer, nature, deſerve likewiſe to be mentioned. The compound flowers are diſtributed into two claſſes by a diſcriminating character which is not ſufficiently conſpicuous, the ſituation of the radicle in the ſeed. There is a confuſed jumble too, in the method, of ſeeds, ſeed-veſſels and cells: and an obſcurity as well as ambiguity in many of the ſcientific terms which render it a perplexed uninviting ſyſtem. In fine, as a firſt attempt, the method juſt illuſtrated poſſeſſes conſiderable merit, but can never be characterized a convenient eaſy mode of arrangement.

The ſections, orders or ſecondary diviſions in Cæſalpinus's method are forty-ſeven in number, and depend upon a variety of parts and circumſtances. The principal of theſe are, the diſpoſition, ſituation and figure of the flowers; the nature of the ſeed-veſſel or cover of the ſeeds; the ſituation of the radicle in the ſeed; the number of ſeed-lobes or ſeminal leaves; the diſpoſition of the leaves, and colour of the flowers. The lacteſcence

ſcence too or milkineſs, which is obſerved in the compound flowers with flat florets, is made a characteriſtic diſtinction, and diſcriminates the firſt order of the twelfth claſs. Thus it is the characters of the claſſes only which, in the firſt ſyſtematic arrangements, were ſolely borrowed from the parts of fructification; thoſe of the ſubaltern diviſions were numerous, and reſpected every part of the plant. Such diviſions, to be perfect, ſhould be conſtituted, like claſſes, from the modifications of a ſingle part of fructification. There are few methods that are not defective in this reſpect: and though I would by no means condemn a plan of arrangement for a ſlight deviation from uniformity in its ſecondary characters, I can have no favourable idea of the leading principle of any method which compels the uſe of a multiplicity of characters from different parts of the plant for diſcriminating the ſubaltern diviſions juſt mentioned.

It might have been expected that a method founded like that of Cæſalpinus upon genuine ſcientific principles, would have been immediately adopted by the learned, and, in eſtabliſhing itſelf, have totally extirpated thoſe inſufficient characters which, during ſo many ages, had diſgraced the ſcience. The fact, however is, that Syſtem periſhed almoſt as ſoon as it had an exiſtence: with Cæſalpinus died his plan of arrangement; and it was not till near a century after, that Dr. Robert Moriſon, of Aberdeen, in Scotland, attaching himſelf to the principles of Geſner and his learned ſucceſſor, re-eſtabliſhed ſcientific arrangement upon a ſolid foundation; and, from being only the reſtorer of Syſtem, has been generally celebrated as its founder. In the long interval betwixt Cæſalpinus and Moriſon, flouriſhed ſome eminent names in Botany. The moſt noted of theſe are, Dalechamp, author of a General Hiſtory of Plants; Theodore, ſurnamed Tabernæmontanus and Thalius, two German writers; Porta, an Italian,

Italian, famous for an arrangement of plants from their relations to the ſtars, to men, and other animals; Proſper Alpinus, author of a catalogue of the plants of Egypt; Fabius Columna, inventor of many of the botanical terms now uſed; the two Bauhins; our two induſtrious countrymen, Gerard and Parkinſon; Zaluzianſki, a Pole, author of an arrangement from the qualities and habit of plants; Marcgrave and Piſo, celebrated for their Natural Hiſtory of Braſil; Hernandez, equally celebrated for his of Mexico; Paſſæus or Du Pas, author of an arrangement of plants from the time of flowering, of all characters the moſt uncertain and inſufficient; Johnſton; Bontius a Dutchman, author of a Natural Hiſtory of the Eaſt Indies; Aldrovandus, the celebrated Naturaliſt; and Rheede, Governor of Malabar, and author of the well-known *Hortus Malabaricus*.

The method propoſed by Moriſon has the fruit for its baſis, like that of Cæſalpinus, to which, however, it is greatly inferior both in the plan and execution. It was Moriſon's great object to inveſtigate the order of Nature, not to fabricate an eaſy method of arranging plants. Hence his ſyſtem, devoid of uniformity, is clogged with a multiplicity of characters; the claſſes are often not ſufficiently diſtinguiſhed from each other; and the key of the arrangement ſeems totally loſt. Moriſon ſets out with a diviſion of plants, from their ſubſtance or conſiſtence, into lignous or woody, and herbaceous. The former, ſubdivided, from their ſize, into trees, ſhrubs and under-ſhrubs, form the three firſt claſſes in the method. Herbaceous plants, which conſtitute the ſecond diviſion, are contained in fifteen claſſes, which have for their characters, the number, figure and ſubſtance of the fruit, the diſpoſition of the flowers, the preſence or abſence of the downy crown of the ſeed, termed *Pappus*, the lacteſcence or milkineſs of ſome plants, the number of petals, and the habit, port or general

neral appearance. The fourth claſs contains climbing plants which have a pulpy fruit of the berry and apple kind; and is exemplified in paſſion flower, briony and cucumber. The fifth and ſixth contain all the pod-bearing plants; and correſpond to the pea-bloom and croſs-ſhaped flowers of later botaniſts. Pods are of two kinds; the one, termed *Legumen*, has two valves or openings, and but one cell: the other, *Siliqua*, has two valves, and the ſame number of cells divided by a partition that runs either parallel to the valves, or in a contrary direction. The leguminous plants conſtitute the fifth; the ſiliquoſe the ſixth claſs, in Moriſon's method. The ſeventh claſs contains plants with ſix petals and a tricapſular fruit, by which the author means a ſingle capſule with three internal cavities or cells. All the liliaceous or bulbous-rooted plants are referred to this diviſion. A variety of plants are made to arrange themſelves promiſcuouſly under the eighth claſs, without any fixed or preciſe diſtinction. The number of petals and cavities of the fruit is announced in the title as the diſcriminating character. In the two next claſſes are placed all the compound flowers, which ſtand thus diſtinguiſhed. Thoſe of the ninth claſs, termed *corymbiferous*, from their growing in cluſters like ivy-berries, have neither a downy crown to the ſeed, nor a lacteſcent or milky ſtalk: thoſe of the tenth on the other hand, have either a lacteſcent ſtalk, or a downy crown to the ſeed. The former claſs is exemplified in tanſy, wormwood, daiſy, fever-few, and milfoil; the latter in ſuccory, hawkweed, dandelion, ragwort, and thiſtle. Under the eleventh claſs are arranged the numerous tribe of graſſes, whoſe characteriſtic diſtinction in this method is a ſingle ſeed to each flower. The twelfth claſs contains the plants termed *umbelliferous*, which have two naked ſeeds joined at their origin, and whoſe flowers conſiſt of five petals, and grow in an umbel. A three-corned capſule with three cells, each containing a ſingle ſeed, characterizes the thirteenth

claſs,

claſs, which is exemplified in ſpurge, and palma chriſti. The fourteenth conſiſts of plants which have flowers with one petal, and four naked ſeeds. It includes both the lip-flowers and rough-leaved plants of Tournefort and Ray. In the fifteenth are placed ſuch plants as have either more than one capſule, or a ſingle capſule with ſeveral cells. It correſponds to the fourteenth claſs in Cæſalpinus's method, and is exemplified in pæony, houſe-leek, and water-lilly. The ſixteenth claſs contains berry-bearing plants which do not climb. Deadly night-ſhade, arum and cyclamen, furniſh examples. The ferns, a well-known tribe of plants, occupy the ſeventeenth claſs, by the name of capillary herbs: and in the eighteenth, which ſerves as an appendix to the method, are placed the moſſes, muſhrooms, ſea-weed, ſeveral aquatic, and ſome other, plants which cannot be referred to any of the foregoing heads.

FROM this ſynopſis the reader may form an adequate judgment of the method under review. It is, indeed, of all others, the moſt difficult in practice, and was therefore not adopted by any ſucceeding writer, except Bobart, who, in 1699, compleated Moriſon's Univerſal Hiſtory of Plants, and an anonymous author, whoſe work appeared in 1720. The fourth and eighth claſſes poſſeſs no genuine diſtinctive character. With the umbelliferous plants are very improperly joined drop-wort, meadow-rue and the *ſtarry* plants of Ray, which laſt have one petal with four diviſions, the flowers not diſpoſed in an umbel, and the leaves placed in whorls reſembling a ſtar round the ſtem. The ninth and tenth claſſes, containing compound flowers, are not ſufficiently diſtinguiſhed; in the latter too are arranged teazel, eryngo, pine-apple, protea, and melon-thiſtle, which have neither a downy crown to the ſeed, nor a milky ſtalk, the diſcriminating characters of the claſs in queſtion. Garden burnet and plantain are made to arrange

range themſelves with the graſſes, although in the former, two, in the latter, ſeveral ſeeds ſucceed each flower. With juſt as little propriety are wood-ſorrel, ſtrawberry, cinquefoil, ladies mantle and barren-wort, which bear no pods, referred to the claſs containing leguminous plants; and anemony, ranunculus and herb-bennet, which have ſeveral naked ſeeds, to the ſeventh claſs, conſiſting of plants with a capſule that has three internal diviſions or cells. The fifteenth claſs is not ſufficiently diſtinguiſhed from the eighth, nor the ſixteenth from the fourth. In this laſt, the characteriſtic diſtinctions are a ſeed-veſſel of the berry or apple kind, and a climbing ſtalk; and yet the title of the very firſt ſection, or ſub-diviſion of the claſs, announces the preſence of berry-bearing plants which do not climb. To the ſame claſs are improperly referred bind-weed, quamoclit, hop and heart-ſeed which have not a berry for their ſeed-veſſel.

MORISON's ſections or ſecondary diviſions, which are one hundred and eight in number, ariſe from the figure and ſubſtance of the fruit, the number of ſeeds, leaves and petals, the figure of the root, the direction of the ſtem, the colour of the flowers, the place of growth, and, in one claſs, from the medicinal virtues of ſome of the plants which compoſe it.

IT is remarkable, that, altho' Moriſon ſet out with the profeſſed deſign of inveſtigating as many of the natural claſſes as poſſible, he has been able to diſcover but two that are compleatly ſo. Theſe are the thirteenth, which, however, contains but two genera, and the ſeventeenth, comprehending the ferns. Some of the other claſſes, particularly thoſe containing the leguminous, ſiliquoſe, and umbelliferous plants, and the compound flowers, have forfeited their title to that appellation, by being encumbered with

ſeveral plants, between which the relations are not ſufficiently numerous.

IMPERFECT as is the mode of diſtribution propoſed by Moriſon, it has furniſhed many uſeful hints, which later botaniſts have not failed to improve. Ray, Tournefort and Linnæus, thoſe great luminaries of the ſcience, have ſucceſſively owed him much, nor are aſhamed to acknowledge the obligation. The firſt-mentioned writer propoſed his method to the world, in 1682, two years after the publication of Moriſon's, which ſerved, in ſome ſort, as its baſis. It orginally conſiſted of twenty-five claſſes, two of which reſpect trees and ſhrubs, and the remaining twenty-three herbaceous plants. This method Mr. Ray carefully retouched, corrected and amended at different times; ſo that the plan of arrangement which now bears the name of that author, and was firſt publiſhed in 1700, is entirely different from that which had appeared in 1682. The thirty-three claſſes of which the improved method conſiſts are derived from the port or habit of plants; their greater or leſs degree of perfection; their place of growth; the number of ſeed-lobes or ſeminal leaves, petals, capſules and ſeeds; the ſituation and diſpoſition of the flowers, flower-cup and leaves; the abſence or preſence of the buds, flower-cup and petals; the ſubſtance of the leaves and fruit; and the difficulty of claſſing certain plants.

THE diſtinction into herbs and trees, with which Ray's method ſets out, acknowledges a different, though not more certain, principle, than that of Cæſalpinus and Moriſon. The former, in making this diviſion, had an eye, with the ancients, to the duration of the ſtem; the latter, to its conſiſtence. Ray has called in the buds as an auxiliary, and denominates trees all ſuch plants as bear buds; herbs, ſuch as bear no buds. The objection which lies

lies againſt Linnæus's diſtinction into ſhrubs and trees from the ſame principle, may be ſtill more powerfully urged in the preſent caſe: for though all herbaceous plants riſe without buds, all trees are not furniſhed with them: many of the largeſt trees in warm climates, and ſome ſhrubby plants in every country, being totally devoid of that ſcaly appearance which conſtitutes the eſſence of a bud.

HERBACEOUS vegetables, which conſtitute the firſt grand diviſion, are diſtributed into a double phalanx of plants which bear flowers, and ſuch as are devoid of flowers. This diſtinction was ſubſtituted in the improved method for that leſs philoſophical one of perfect and imperfect plants, which had been originally employed. The four firſt claſſes exhauſt the diviſion ariſing from the abſence of the flower. Of theſe the ſubmarine plants occupy the firſt; the muſhrooms, moſſes and ferns, the remaining three. Submarine plants are ſuch as grow in the bottom of the ſea, or upon rocks that are ſurrounded by that element. They are either of a very hard ſtony nature, as the plants termed Lithophyta; of a ſubſtance reſembling horn, as the corallines; or of a ſofter, herbaceous texture, as the fuci, ſpunges, and ſea-moſſes. The corallines have ſucceſſively paſſed through each of the three great claſſes or kingdoms of Nature. Some Naturaliſts have not ſcrupled to refer them to the mineral kingdom; the greater part have arranged them with vegetables; and it was not till lately that their real nature was clearly aſcertained, and they demonſtrated, by a ſeries of well-atteſted experiments, to be true ramified animals. The animality, if I may uſe that expreſſion, of this ſingular tribe of natural bodies had been juſt hinted at by Imperati, an Italian, in 1599, and afterwards, by Peyſſonel in 1727: but it is to M. Bernard Juſſieu, a French academician, and the ingenious Mr. Ellis, that we owe deciſive facts, and a regular detail upon this

ſubject. The former, in ſeveral papers to be found in the Memoirs of the French Academy of Sciences for 1741, has demonſtrated theſe marine bodies to be true animal productions; the latter, in his Natural Hiſtory of Corallines, has, with indefatigable labour, parcelled them out into their ſeveral genera, by means of fixed, invariable characters obvious in their appearance.

THEIR place of growth, which is out of the water, ſerves to diſcriminate muſhrooms, moſſes and ferns, the three remaining claſſes of plants that want the flower, from the ſubmarine productions which conſtitute the firſt claſs. But how are they diſtinguiſhed from one another? Of all the vegetable tribes, muſhrooms are the leaſt certainly known. With the more perfect plants, indeed, they poſſeſs ſcarce any characters in common. They have no leaves; in colour and texture they generally differ from herbaceous plants: and it was not till 1729 that Micheli diſcovered in ſome of them appearances reſembling ſtamina and ſeeds. Moſt of them attain the higheſt perfection of their nature in a very ſhort ſpace of time, and diſappear with proportionable celerity. Mr. Ray ſubdivides the muſhrooms into two orders or ſections; the one containing ſuch as have the under part of the crown or hat divided into *Lamellæ* or thin plates; the other ſuch as exhibit no appearance of this kind. In the firſt order the hat, which is generally ſupported by a footſtalk, does not poſſeſs the ſame conſiſtence throughout. The upper ſurface is homogeneous, undivided, and generally of the ſame colour internally with the footſtalk: the lower is moſt commonly of a different colour, and divided into thin plates. Muſhrooms which have nothing analogous to the thin plates juſt mentioned, are of various forms: ſome are of a ſubſtance reſembling parchment or leather, as Jew's Ears; others imitate in conſiſtence a honey-comb: ſome are club-ſhaped, ſome round, ſome branched. In both orders there

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are paraſitic plants, which draw nouriſhment from the trees that ſupport them. Jew's Ears is produced upon the elder; agaric upon the larch. Truffles, known among botaniſts by the name of *tubera terræ*, are produced under-ground. Ray's characters of the moſſes are not in the ſpirit of genuine ſyſtematic arrangement. The fructification of that numerous tribe of plants had not then been diſcovered; ſo that a general deſcription of the claſs was neceſſarily ſubſtituted for true ſcientific diſtinctions. Moſſes are defined to be vegetables of extreme minuteneſs, and of a dry, arid ſubſtance, which grow upon ſtones and trees, in ſqualid barren places that are burnt up by heat, or impoveriſhed by cold. They poſſeſs likewiſe the ſingular property of reſuming their original verdure, by immerſion in water, after having been dried for years; and are ſo ſlow in tranſmitting heat and cold, that it is found convenient to employ them in preſerving dry ſuch bodies as are ſuſceptible of moiſture, and in retaining the humidity of young plants, which are to be tranſported to a great diſtance, without expoſing them to putrefaction. The *antheræ* and ſeeds of the moſſes were detected by Dillenius in 1719 and 1741. At the firſt publication of his method, Ray conſidered the ferns as a ſort of ramified leaves, and hence adopted for their diſtinctive character, the abſence of the ſtem. In the ſequel, however, he was convinced that the character in queſtion, however proper for diſcriminating the European ferns, was altogether inadequate for diſtinguiſhing thoſe of India and America, many of which have true genuine ſtems. Obliged then to abandon his firſt and moſt obvious diſtinction, becauſe wanting in univerſality, he had recourſe, in his improved method, to the minute organs of fructification, which, by the induſtry of ſome lovers of the ſcience, had begun to be inveſtigated. The illuſtrious Tournefort, whoſe method and judicious diſtribution of the genera furniſhed Ray with the greateſt part of his corrections and amendments, had, in arranging

ranging the ferns, deſcribed them to be plants wanting the flower, but furniſhed with ſeeds, which grow upon the back of the ramified leaf or ſtem. Neither of theſe characters, nor both in conjunction, appeared to Mr. Ray ſatisfactory. Profeſſor Rivinus, Mr. Ray himſelf, and Father Plumier had, by this time, diſcovered the flowers of ſome of the ferns; and were hence led by analogy to conclude their exiſtence in all. The laſt mentioned author, in particular, deſcribing a ſhrubby American fern, ſays, that the ſeminal knobs on the back of the leaf appeared to be preceded by very ſmall florets of one petal, within which were a number of exceedingly minute filaments or threads. The other diſtinction employed by Tournefort reſpecting the place of the ſeeds, ſeemed equally improper. In royal oſmund, or flowering fern, and adder's tongue, the middle rib overtops the leaf, and forms a footſtalk for ſupporting the panicle or head of flowers. Thus the ſeeds are always ſeated upon the leaves, though not always upon their back or lower ſurface. Mr. Ray, therefore, to avoid all altercation, and render the diſtinctive character as exact as the nature of the tribe of plants would admit, has corrected Tournefort's deſcription, and, in the improved edition of his method, defined the ferns to be plants with a very minute duſty ſeed, which always grows on the leaves, and generally on their back or under ſurface. It deſerves to be remarked that Ray, although convinced of the exiſtence of the flower in theſe plants, has arranged them in a diviſion, the characteriſtic diſtinction of which is the abſence of that organ. The parts in queſtion were neither perfectly diſtinguiſhed, nor ſufficiently conſpicuous to entitle the plants to a place in a diviſion where the exiſtence of the flower was, in no ſort, dubious. Some ferns produce their ſeeds on the margin of the lower ſurface of the leaves, as maiden-hair, and the common female fern, generally known by the name of brakes: but the greater part produce them towards the mid-

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dle or inner ſurface; and that either in double rows of iron-coloured points or knobs, as in polypody, and moſt ſpecies of male fern; in vermicular or oblique lines, as in hart's tongue and black maiden-hair; in lines which run longitudinally downwards parallel to the middle rib of the leaves, near which they are placed, as in *blechnum*; or in cluſters over the whole ſurface, as in ſpleen-wort, generally known by the name of Ceterach of the ſhops. The ſtamina and ſeeds of ſome of the ferns were diſcovered by M. de Juſſieu in 1739; thoſe of ſeveral others by M. Maratti in 1760. Dr. Bobart is ſaid to have been the firſt who recognized the ſeeds of this tribe of plants.

We have now ſufficiently illuſtrated the four claſſes of plants in which the parts of the flower are either wanting, or obſcurely viſible, and aſſigned the characteriſtic diſtinction of each claſs. The diviſion of flower-bearing herbs, which comes next to be evolved, comprehends twenty-one claſſes; and theſe the author parcels out into a double phalanx, from an attention to the number of ſeed-lobes or ſeminal leaves. To underſtand the diſtinction referred to, the reader will pleaſe to obſerve that moſt ſeeds have two diſtinct nutritive lobes that enfold the radicle or embryo-plant, and commonly ſhoot up out of the ſoil, for the purpoſe of defending and nouriſhing the infant-ſtem, in the form of two leaves, termed Seminal, becauſe they are immediate productions of the lobes of the ſeed, and bear no reſemblance to the ſucceeding leaves of the plant. In pea, bean, and the other leguminous plants, the lobes in queſtion are diſtinctly viſible: but in theſe, it is to be obſerved, as likewiſe in the lip-flowers, and ſome other plants, they remain unchanged, and do not ſpring up in the form of ſeminal leaves. Again, there are herbaceous plants, tho' thoſe but proportionally few in number, which have only one lobe to the ſeed, and riſe with leaves perfectly ſimilar in form to

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the leaves which ſucceed. This being premiſed, Mr. Ray's diviſion of the flower-bearing herbs will be clearly underſtood. Nineteen claſſes, from the fifth to the twenty-third, both inclusive, contain herbaceous plants which have either two ſeed-lobes, or riſe with two ſeminal leaves. The twenty-fourth and twenty-fifth claſſes, the two laſt in the diviſion under review, conſiſt of plants which have only one ſeed-lobe, and conſequently, do not, like thoſe of the preceding claſſes, protrude, in germinating, two ſeminal leaves, of an irregular form, and totally unlike the leaves that are afterwards protruded.

Such is the foundation of Mr. Ray's diſtinction of plants into *Dicotyledonous* and *Monocotyledonous*. The former have two ſeed-lobes or ſeminal leaves, the latter but one. In both, the ſeed-lobe performs the office of the *cotyledon* or *placenta* in animals, by preparing the nouriſhment, and tranſmitting it elaborated to the infant plant. Herbs which have two ſeed-lobes, or riſe with two ſeed-leaves, are ſubdivided by Mr. Ray into ſuch as bear flowers with petals, and ſuch whoſe flowers have no petals. This diviſion requires to be explained. The preſence of the flower-cup, petals, ſtamina with their tops, and ſtyle or pointal conſtitutes a perfect flower. The ſtamina and ſtyle are eſſential to its exiſtence; their abſence therefore is incompatible with the idea of a flower; not ſo the flower-cup and petals; the former of which organs may be wanting, without deſtroying the perfection of the flower: the latter, though of more importance, does not, by its abſence, annihilate the flower, but only renders it imperfect. Upon this doctrine of Mr. Ray is founded the diſtinction juſt mentioned. Some herbaceous plants which riſe with two ſeminal leaves, bear flowers conſiſting of the ſtamina, ſtyle and flower-cup only, without the petals: but in the greater part, the flowers are perfect, that is, conſiſt of ſtamina, ſtyle and petals,

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with or without the cup. If in the ſecond branch of this diviſion no plants found a place that were not abſolutely compleat in the parts of fructification, I ſhould not ſcruple to pronounce it an excellent diſtinction. But Mr. Ray having arranged with the compleat flowers ſome which want the calix or flower-cup; and there being no certain criterion whereby to diſtinguiſh the calix from the petals in flowers which have only one of the covers preſent, we ſhall frequently be puzzled in aſcertaining to which branch of the diviſion the plant in queſtion ought to be referred. When both organs are preſent, there can be no doubt, even although the calix ſhould emulate the petals in colour, texture and fugacity, as it manifeſtly does in muſtard and crowfoot; or even in ſtability and duration, as in orpine and greater houſe-leek. In the caſe alluded to, the calix is always with facility diſtinguiſhed from the petals by its exterior ſituation, and uſe in containing and ſupporting the flower. But if one of the parts in queſtion only is preſent, by what rule ſhall we determine its genuine nature, and whether the organ that is wanting be more or leſs eſſential to the perfection of the flower? Let us hear Mr. Ray's ſentiments on this ſubject. The flower-cup, ſays that author, in his Diſſertation on the various plans of arranging vegetables, may always, with accuracy, be diſtinguiſhed from the petals, by its leſs delicate texture, its want of colour, and above all, its aptitude to continue till the maturity of the fruit, to which it frequently ſerves the purpoſe of a veſſel or covering. Hence it is, he continues, that thoſe flowers are to be deemed without petals, in which the parts that ſurround the ſtamina are of an herbaceous colour and conſiſtence, or continue upon the plant till the fruit has attained its full ſize and maturity; thoſe, on the other hand, want the flower-cup, in which the aforeſaid parts are either of a different texture and colour, or, devoid of ſtability, fall off or wither before the ripening of the ſeed. To take an example. In

the flowers of hop, nettle and hemp, the only cover preſent is determined to be the flower-cup, from its herbaceous texture and colour; as is likewiſe that of buck-wheat, biſtort and perſicaria, from its durability, although, in theſe laſt, the part in queſtion exactly reſembles petals in its form and colour. None of the characters aſſigned by Mr. Ray are ſufficient to diſtinguiſh the petals from the flower-cup. In plants which have both organs preſent, and it is in ſuch only that we can look for accurate marks of diſtinction, the flower-cup ſometimes falls off, as in the poppy and barren-wort, at the opening of the flower; ſometimes with the petals and ſtamina, as in the croſs-ſhaped flowers. Neither is the ſame part in all plants of an herbaceous colour; crow-foot, water-creſs, gold of pleaſure, Indian-flowering reed, broom-rape, calycanthus, and ſeveral others, have a coloured calix. In *bartſia*, it is red as blood. Again, in the paſſion-flower, the petals are of the ſame herbaceous colour as the calix; in the water-lilly, they are permanent, that is, continue till the fruit has attained maturity; and in the genus *ſelago*, perform the office of a capſule by incloſing and involving its ſingle ſeed. The truth is, that nature has placed no abſolute limits betwixt the calix and the petals; ſo that where either is wanting, no rule can be aſſigned that, in all caſes, ſhall determine, with certainty, the genuine nature of the organ that remains. In ſome plants, particularly ſparrow-wort, ſtar of Bethlehem, white hellebore, ſpider-wort, and ruſh, the two organs in queſtion grow together, and are formed into one and the ſame body; ſo that the flower, when unfolded, is outwardly of a coarſe texture and green herbaceous colour; inwardly, of a fine delicate frame and beautiful colour, which it often changes, when flowering is accompliſhed, for the herbaceous colour of the under ſurface, and, in this calix-like form, continues with the fruit to its maturity. This obſervation is as old as the time of Cæſalpinus. Neither are we, with ſome botaniſts,

botaniſts, to conclude that the petals, becauſe the more excellent organ, are never wanting; ſince, in flowers which have both calix and petals, the latter is occaſionally dropped, the former never. Bell-flower and water-purſlane furniſh examples of the fact alluded to. M. Tournefort has adopted for his primary and ſole diſtinction of petal-wanting flowers, the durability of the calix combined with its uſe in ſerving as a veſſel for incloſing and covering the ſeeds. The former character being proved to be inſufficient, the latter, which has no exiſtence without it, can ſcarce be deemed highly certain. In fine, I cannot help thinking both Ray and Tournefort's diſtinction of petal-bearing and petal-wanting flowers to be exceedingly improper, becauſe, in no ſort, calculated to facilitate the knowledge of plants. At the ſame time, I can conceive a very eaſy method of removing the ambiguity, by arranging under one diviſion all plants which are compleat in the parts of fructification, and under its oppoſite diviſion, ſuch plants as are deficient in either of the two covers of the flower generally known by the names of calix and petals. By ſuch a mode of diſtribution, a plant is no ſooner viewed than its place is finally and certainly determined: if both the organs in queſtion are preſent, it is referred, without heſitation, to the firſt diviſion; if only one, we loſe no time in enquiring, whether it is the calix or petal, but refer it, with equal facility, to the ſecond.

The petal-wanting flowers conſtitute the fifth claſs in Ray's method. Of theſe ſome want both calix and petals, as glaſs-wort, triple-headed pond-weed, and *hippuris*; the reſt, which want only one of the covers, are ſubdivided into ſuch as have the flower placed at a diſtance from the fruit, and ſuch as have it contiguous. In hop, hemp, nettle, ſpinach, and mercury, the flower and fruit are produced upon different plants raiſed from the ſame ſeed. In *Ambroſia*, leſſer burdock, palma chriſti, and

baſtard ricinus, they ſtand upon different parts of the ſame individual plant; the ſtamina with its cover forming the flower, the ripened ſeed-bud the fruit. Of petal-wanting herbs which have the flower placed contiguous to the fruit, that is, the ſtamina ſituated along with the pointal or ſtyle within the only cover that is preſent, ſome have a three-cornered ſeed, as dock, buck-wheat, biſtort and knot-graſs; ſome a roundiſh ſeed, as orach, blite, pellitory, ladies mantle and rupture-wort; and others, as beet, golden ſaxifrage, amaranthus and plantain, have their ſeeds contained in a veſſel.

HERBACEOUS plants which riſe with two ſeed-leaves and have petals, come now to be conſidered. Theſe are contained in eighteen claſſes, and bear flowers which are either ſimple or compound. The compound flowers conſtitute the ſixth, ſeventh, eighth and ninth claſſes; in the fourteen claſſes which immediately ſucceed theſe, the flowers are all ſimple. This diſtribution, which is borrowed from Tournefort, requires explanation. A compound flower, according to Mr. Ray, is an aggregate of ſeveral partial or leſſer florets, each of which is furniſhed with its own proper petal, ſtamina, ſtyle and ſingle ſeed. In a flower of this deſcription, continues the ſame author, all the florets are contained within a common calix or flower-cup; the ſeeds are naked, cloſely arrayed, and placed each under its own proper floret; and there is a circle of larger petals in the circumference or margin of the aggregate, which ſurround the florets in the middle in the form of rays. By theſe characters, the author conceives that compound flowers may with facility be diſtinguiſhed from thoſe modes of flowering termed an *Umbel*, *Corymbus* and *Spike*, with which they might otherwiſe be confounded. He at the ſame time cautions us from wrongly imagining that either of the characters juſt mentioned is ſingly ſufficient to conſtitute a com-

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pound flower. The preſence of the two firſt is abſolutely neceſſary. In fact, there are ſome flowers, as ſea-pink and horned rampions, which, although a real aggregate, and contained within a common calix, are not to be ranked as compound flowers, becauſe each floret is furniſhed with its own proper calix, and has likewiſe a capſule for containing the ſeeds.

THE ſixth claſs of Ray's method contains compound flowers which conſiſt entirely of flat tongue-ſhaped florets. The plants of this claſs have a lacteſcent or milky ſtalk, and correſpond to part of the tenth claſs in Moriſon's method. They are diſtributed by Ray into two ſections; the firſt containing ſuch lacteſcent compound flowers as have their ſeeds furniſhed with a *pappus* or downy crown for their more convenient diſperſion; the ſecond, ſuch whoſe ſeeds are ſolid, that is, want the crown alluded to. Lettuce, hawkweed and dandelion arrange themſelves under the firſt ſection; ſuccory and nipple-wort, under the ſecond. The flowers of this claſs are defined by Jungius to be ſuch as have plain florets, and are naturally full. The ſeventh and eighth claſſes contain the radiated flowers of Tournefort. They are diſcriminated by the *pappus* or downy crown of the ſeed, which, in the former, is preſent, in the latter wanting. On the whole, however, theſe two claſſes are the leaſt accurately diſtinguiſhed both from one another, and from the other compound flowers, of any claſſes or ſections in the method. The ninth claſs contains compound flowers conſiſting of ſeveral oblong hollow florets, which are generally divided or cut into long ſegments. This claſs Mr. Ray has denominated *Capitatæ*, becauſe the common calix in the plants pertaining to it ſwells out, particularly after the fall of the flower, into a prominence reſembling a head. Thiſtle, blue-bottle, burdock and ſafflower furniſh examples. With the compound flowers are very improperly arranged ſcabious,

bious, teazel, blue daiſy and eryngo, which have not all the characters ſufficient to conſtitute a compound flower; each floret in the aggregate being furniſhed with its own proper calix, altho', like the flowers in queſtion, it is generally placed upon a ſingle naked ſeed.

HERBACEOUS plants with two ſeminal leaves and a ſimple flower conſtitute the next fourteen claſſes, and are ſubdivided from an attention to the ſeeds, which are either naked, or incloſed in a caſe or veſſel. The number of naked ſeeds next demands attention; and herein Mr. Ray differs from Cæſalpinus, who made number his primary diſtinction, ſubordinate to which was placed that ariſing from the preſence or abſence of a veſſel for containing the ſeeds. In the plants of the tenth claſs, each flower, which is perfect and ſimple, is ſucceeded by a ſingle naked ſeed. Sea lavender, marvel of Peru, valerian and fumatory are adduced as examples. The eleventh claſs conſiſts of herbaceous plants which bear two naked ſeeds. Theſe are the plants well known among botaniſts by the name of Umbelliferous, from the mode of flowering, which reſembles an umbrella. The footſtalks which ſupport the flowers in this tribe of plants proceed like rays from the ſame center, and riſe to an equal height, ſo as to form an even ſurface at top. Each ray too, in moſt umbelliferous plants, is branched out, near the top, into ſeveral partial or leſſer footſtalks, which ſupport a ſecondary umbel in every reſpect ſimilar to the larger or univerſal one; this laſt being in fact only an aggregate of the ſeveral leſſer umbels juſt mentioned, which altogether form the figure of an inverted cone. The umbelliferous plants are diſtributed by Ray, from the form of the leaves, which, in ſome, are ſimple and undivided; but in the greater number, winged or branched, that is, cut into ſeveral lobes or partial leaves. Of umbelliferous plants with divided or

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diſſected leaves, ſome have broad compreſſed ſeeds, with a leafy wing or border, as cow-parſnep, hart-wort, fennel-giant, and maſter-wort; in others, the ſeeds ſwell out into a different form, and are either very large, of a fungous ſubſtance, and contain a kernel, as in *cachrys*; of a ſpherical figure, as in coriander; long, narrow, and reſemble a bird's beak, as in chervil and Venus's comb; furniſhed with many membranaceous wings that run longitudinally downwards, as in laſerwort; long, large and furrowed, as in myrrh, ſometimes known by the name of ſweet fern; ſtreaked, and of a middling length and thickneſs, as in ſpignel, lovage and fennel; hairy, as in carrot; or prickly, as in baſtard parſley. Sanicle, hare's ear and black maſterwort, are the umbelliferous plants with ſimple leaves; to theſe may be added eryngo, which Ray has placed very improperly among the compound flowers. The twelfth claſs contains plants which, like thoſe of the former, have two naked ſeeds under each flower, but are in other reſpects ſo very unlike the umbelliferous plants, that Mr. Ray has judged very properly in correcting this part of Moriſon's plan, which jumbled theſe two claſſes promiſcuouſly together. The plants in queſtion have their flowers deeply cut into four ſegments reſembling ſo many diſtinct petals; and the leaves placed in whorls round the ſtalk at certain diſtances, in the form of a radiant ſtar: from which laſt circumſtance is derived the name *Stellatæ*, that is, ſtar-like plants, by which the claſs under review is diſtinguiſhed. Mr. Ray ſubdivides theſe plants, from the tube of the flower, which in ſome, as petty madder, is long; but in the greater part, very ſhort. Of ſuch as have a ſhorter tube, ſome produce their leaves by fours in the form of a croſs; in others the leaves grow in greater number, and thoſe either ſmooth, as in yellow ladies bed-ſtraw and wild madder, the *galium mollugo* of Linnæus; or rough, as in cleavers, and woodroof. Four naked ſeeds in the bottom of the flower-cup

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characterize the two next claſſes, which ſtand thus diſtinguiſhed. In the thirteenth the plants have rough leaves that are either placed alternately or without any order upon the ſtalk; and flowers of one petal, with the brims deeply cut into five ſegments. The flower-cup too is ſlightly divided into five; and, in ſome of the genera, the uppermoſt part of the ſpikes of flowers is twiſted, before their expanſion, into the form of a ſcorpion's tail. In the fourteenth claſs, the leaves are placed oppoſite by pairs; the flowers generally ſurround the ſtalk in whorls, and conſiſt of one petal with two irregular lips, the uppermoſt of which, in the greater number of plants, reſembles a helmet. The firſt mentioned claſs is exemplified in lungwort, comfrey, ſcorpion-graſs and borrage; the other in ſage, hyſſop, betony, roſemary, and the other lip-flowers. Moriſon joined theſe two claſſes into one; Ray has with great propriety ſeparated them. The fifteenth claſs contains plants in which each flower is ſucceeded by more than four naked ſeeds. Crow-foot, adonis, water-plantain, tormentil, cinquefoil and herb-bennet, furniſh examples. In his Hiſtory and Synopſis of Britiſh Plants, Mr. Ray refers to this claſs the mallow tribe, which, in his improved method, he has very judiciouſly transferred to the nineteenth.

Such are the diſtinctions of ſimple flowers ariſing from the number of naked ſeeds. In the eight following claſſes, the ſeeds are contained in a caſe or veſſel, which is either pulpy or of a ſubſtance reſembling parchment. The ſixteenth claſs contains herbaceous plants which have a large ſucculent ſeed-veſſel of the apple kind, covered with a thick rind or ſkin. The flowers are of one petal with five ſlight diviſions, and ſtand upon the top of the fruit. Cucumber, gourd, melon, and balſam-apple, afford examples of the claſs in queſtion. Paſſion-flower too is arranged by the author with the plants juſt mentioned, although it agrees with

with them in nothing ſave the characteriſtic diſtinction of the claſs. The berry-bearing herbs which conſtitute the ſeventeenth claſs are diſtinguiſhed from thoſe having a pulpy fruit of the apple kind by the thin membranaceous ſkin that involves the pulp and ſeeds intermixed with it. Bryony, butcher's broom, night-ſhade, winter-cherry, capſicum, arum, aſparagus, and herb-chriſtopher, are referred with ſeveral others to this claſs. To each flower in plants of the eighteenth claſs ſucceed many diſtinct capſules or ſeed-veſſels of a membranaceous ſubſtance. They are divided into two ſections, from the conſiſtence of the leaves, which in ſome is thick and ſucculent; in others, ſlender and dry. Navel-wort and houſe-leek pertain to the firſt ſection; pæony, hellebore, apocynum, ſwallow-wort, monks-hood, columbine and fraxinella to the ſecond, which is ſubdivided from the regularity and irregularity of the flower. The plants with a ſingle dry membranaceous ſeed-veſſel are contained in the five ſucceeding claſſes, which ſtand diſtinguiſhed from the number of petals of which the flower conſiſts. In the nineteenth claſs, the plants have a ſingle membranaceous fruit or ſeed-veſſel with a divided or undivided cavity, and regular or irregular flowers of one petal. Tobacco, gentian, convolvulus, fox-glove, birthwort and toad-flax furniſh examples. The twentieth claſs, which was inſtituted by Dillenius, contains capſular plants with two or three petals, and is exemplified in enchanter's night-ſhade, frog's-bit and water-ſoldier. Ray's twenty-firſt claſs correſponds to the ſixth in Moriſon's method. In the plan under review, its characters are, flowers with four regular petals that are ſucceeded by ſeed-veſſels of the *ſiliqua* or pod kind. The flower-cup too, in moſt of the ſpecies, falls off with the flower; the leaves are placed alternately upon the ſtem; there is a conſtant ſucceſſion of heads of flowers on the ſummit of the branches; and the flower-ſtalks have no *ſtipulæ* or ſmall auxiliary leaves ſtationed at

their origin. Rue, epilobium, poppy, and ſome other plants, are made very unſyſtematically to arrange themſelves under the claſs in queſtion. The leguminous plants, which conſtitute the twenty-ſecond claſs, are characterized by Mr. Ray, after Tournefort, from the irregularity of their petals, which are generally four in number, and reſemble a butter-fly with its wings expanded. The petals agree neither in figure, proportion, nor ſituation; the uppermoſt, generally larger and broader than the reſt, is termed *the ſtandard*; the lowermoſt, involving and defending the ſtamina and embryo ſeed-veſſel, *the keel*; the two ſide petals which reſemble each other in form, *the wings*. Leguminous plants are primarily ſubdivided by Mr. Ray from the leaves, which in ſome are *trifoliate*, that is, compoſed of three diſtinct lobes or leſſer leaves connected on the top of a common footſtalk; in others, *pinnated* or *winged*, that is, compoſed of more leſſer leaves than three arranged on both ſides of a common *coſta* or middle rib; in ſome, finger-ſhaped; in others, ſimple. Of ſuch as have not trifoliate leaves, the greater part bear pods containing a ſingle row or ſeries of ſeeds; in a few, as aſtragalus and *biſerrula*, the pods are divided by a longitudinal partition into two cells, each containing its own proper ſeries. Again, ſimple pods are either jointed, or not jointed. The former are compoſed of ſeveral knots reſembling joints, in each of which is contained a ſingle ſeed; the latter have an undivided cavity and no joints. French honeyſuckle and horſe-ſhoe vetch furniſh examples of the jointed pod; lupine, pea and bean of that which has no joints. Of theſe laſt, ſome climb or are furniſhed with tendrils, as vetch, and everlaſting pea; others want tendrils, and have their leaves either finger-ſhaped, as in lupine; pinnated or winged, as in ſaint foin and liquorice; or ſimple, as in crimſon-graſs vetch, the *lathyrus niſſolia* of Linnæus. Leguminous plants with trifoliate leaves are ſubdivided into ſuch as have a twining, and ſuch as have an

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erect ſtem. Kidney-bean is adduced as an example of the one; trefoil, melilot, reſt-harrow and fenugreek of the other. The twenty-third claſs contains plants which have their ſeeds contained in a capſule or dry ſeed-veſſel, and flowers compoſed of five petals. Theſe are ſubdivided from the diſpoſition of the leaves, which in ſome, as carnation, lychnis, and St. John's wort, ſtand oppoſite in pairs; in others, as purſlane, ſaxifrage and winter-green, are placed alternately, or without any order upon the ſtalk. Dillenius inſtituted a new claſs, to be placed immediately after the twenty-third, conſiſting of capſule-bearing plants which have ſix or more petals. To this diviſion are referred water-purſlane, purple willow-herb and water-lilly.

The firſt grand diviſion of flower-bearing herbs being exhauſted, we proceed to the ſecond, which includes all herbaceous plants having one ſeed-lobe, or that riſe with a ſingle ſeed-leaf. This diviſion contains but two claſſes, and is ſubdivided, like the former, from the preſence and abſence of the petals. The twenty-fourth claſs conſiſts of plants which have a ſingle ſeed-lobe or ſeminal leaf; flowers compoſed either of ſix petals, or of one deeply cut into ſix ſegments; and a capſule or dry ſeed-veſſel divided internally into three cavities or cells. Theſe are the liliaceous or bulbous-rooted plants, which, beſides the characters juſt mentioned, have generally ſimple, graſſy, ſword-ſhaped leaves that are perfectly entire. In his original method, as likewiſe in his Hiſtory of Plants, publiſhed in 1686, Mr. Ray diſtributed the plants in queſtion into two claſſes, by the names of *bulboſæ*, and *bulboſis affines*, that is, bulbous-rooted herbs, and ſuch as bear an affinity to them. As ſome plants, however, which manifeſtly pertain to this claſs, would be excluded, by adopting the form of the root for the claſſical diſtinction, he has very properly rejected it in his improved method for that more ſyſtema-

tical character derived from the nature and internal diviſions of the ſeed-veſſel. Some ſpecies of Iris have a bulbous, ſome a tuberous, ſome a fibrous root. The genus certainly belongs to the claſs under review, yet could not have all its ſpecies referred to it, if the form of the root was made the claſſical diſtinction. Again, a ſpecies of ranunculus with a bulbous root, and ſome other herbs which manifeſtly belong to very different claſſes, would arrange themſelves with the liliaceous plants, if, in diſcriminating this diviſion of the method, the form of the ſeed-veſſel had not been ſubſtituted for that of the root. Indeed, as the claſs now ſtands, there are ſome bulbous-rooted plants referred to it which have not the claſſical character, a capſule divided into three cells. Such are orchis, ladies ſlipper, bee-flower, and limodorum, whoſe ſeed-veſſel or capſule has properly an undivided cavity. Mr. Ray, in his improved method, ſubdivides the liliaceous flowers into three ſections. The firſt contains ſuch as have a ſingle petal divided at the brim into ſix ſegments, as hyacinth, aſphodel, meadow-ſaffron, crocus, narciſſus, iris and aloe: in the ſecond are three diſtinct petals, of which flower-of-a-day, ſometimes called Virginian Spider-wort, is the only example: and in the third are contained plants with ſix diſtinct petals, as lilly, tulip, ſtar of Bethlehem, Guernſey-lilly, and crown-imperial. The twenty-fifth claſs contains the graſſes, which, in the method under review, ſtand diſtinguiſhed from the liliaceous plants, by the abſence of the petals. Their other characters are, a cylindrical, jointed and generally hollow ſtalk; ſeveral ſlender, undivided, pointed leaves, which proceed ſingly from the joints, and are ranged alternately; and a ſingle naked ſeed under each flower. This claſs is ſubdivided into ſuch as bear larger ſeeds, as wheat, rye, oats, and the other kinds of corn, which furniſh food to man; and into the graſſes properly ſo called, which have a leſſer grain, and are the principal nouriſhment of other animals. Ruſh, cy-

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preſs-graſs, burr-reed, and a few other plants which have an affinity to the graſſes, are referred to a ſeparate ſection. The twenty-ſixth claſs ſerves as an appendix to the firſt part of the method, and conſiſts of ſuch herbaceous plants as do not properly arrange themſelves under any of the foregoing claſſes. This diviſion was expunged by Dillenius, who has diſtributed all the Britiſh plants pertaining to it among thoſe claſſes in the method to which they ſeemed to have the greateſt affinity.

We come now to ſubdivide trees and ſhrubs, which are primarily diſtinguiſhed, like herbaceous plants, from the number of ſeed-lobes or ſeminal leaves. The curious tribe of palms are the only trees that have a ſingle ſeed-lobe. Theſe, therefore, ſingly conſtitute the twenty-ſeventh claſs, which, from the reſemblance of the leaves of the plants in queſtion to thoſe of reeds, has obtained the name of *Arundinaceæ*. Of trees which riſe with two ſeminal leaves, ſome have the flower placed at a diſtance from the fruit, either on the ſame or different plants, obtained from the ſame ſeed; whilſt others have the flower and fruit placed contiguous. The twenty-eighth claſs conſiſts entirely of trees of the former deſcription. In theſe plants, the fruit is either hard, dry, ſcaly, and formed into a cone, as in fir, pine, cypreſs, and *arbor vitæ*; dry, but not ſcaly, nor cone-ſhaped, as in box; or of the nature of a berry or nut, as in juniper, yew, mulberry, walnut, hazel and oak. Trees which have the flower contiguous to the fruit, are arranged under the four following claſſes. Theſe are primarily ſubdivided from the ſituation of the flower, which, in ſome, ſtands upon the top of the fruit, and, in others, ſurrounds it or coheres to its baſe. In ſuch as have the flower ſeated upon the fruit, the calix is permanent, and, after the fall of the flower and conſequent ſwelling of the ſeed-bud, forms in the fruit at the end oppoſite to the footſtalk a cavity which, from its reſem-

reſemblance to a navel, has obtained among botaniſts the name of *Umbilicus*. The plants of the twenty-ninth claſs have all an umbilicated fruit, and that either of the apple or berry kind, as pomegranate, pear, quince, medlar, roſe, gooſeberry, ivy, viburnum and elder. In the three following claſſes, the flower ſurrounds the fruit or coheres to its baſe, ſo that no *umbilicus* or cavity can be formed by the calix. The thirtieth claſs contains trees which, beſides the common character juſt mentioned, have always a pulpy fruit, either of the cherry, berry or apple kind. It is exemplified in plumb, almond, apricot, peach, miſletoe, mock-privet, jeſſamy, arbutus, orange, cuſtard-apple and calabaſh. In the thirty-firſt claſs, the ſeed-veſſel is dry, but not of the pod kind. In the thirty-ſecond, the plants are leguminous, that is, bear pods, and have generally a papilionaceous or butterfly-ſhaped flower. Elm, maple, aſh, lime and mock orange, arrange themſelves under the former; tamarind, acacia, broom and coronilla with many others, under the latter. There remains only one claſs, the thirty-third, which ſerves, in ſome ſort, as an appendix to this part of the method, as the twenty-ſixth does to the diviſion of herbaceous plants. It contains only one genus, the fig, which differs from all other trees in having the flower concealed within the fruit.

Thus have I, with conſiderable labour, toiled through the numerous claſſes of this complex and highly intricate method of arrangement. Were I to pronounce with impartiality of its merits and defects, I ſhould not ſcruple to aſſert, that, however beautiful in the idea, neither the plan nor execution is, in any degree, calculated to facilitate the knowledge of plants. In fact, it ſeems to have been Ray's great object, no leſs than that of Moriſon, to collect as many natural claſſes as poſſible; and theſe being ſeparately inveſtigated, a multiplicity of characters and ſteps

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was neceſſarily required to connect them. Hence the intricacy complained of, which muſt always exiſt, where the claſſes give riſe to the connecting characters, not the characters to the claſſes. Eminent as is the rank of this author in the liſt of botanical writers, ſeveral inſtances could be adduced in which the execuion is inferior even to the plan, and vegetables are erroneouſly referred to particular branches of the method. In anatomizing the claſſes, I had occaſion to mention ſome improprieties of this kind. The following, not hitherto recorded, deſerve attention. Agrimony has two naked ſeeds that are lodged in the bottom of the calix, yet is referred by Ray to the tenth claſs, which, as the reader will obſerve, contains plants whoſe flowers are ſucceeded by a ſingle naked ſeed. To the ſame claſs are referred fumatory and meadow-rue; although the former is furniſhed with a ſeed-veſſel, and the latter has many naked ſeeds inſtead of one. The diſtinction from the number of ſeed-leaves, however proper in detecting the order of nature, or connecting aſſemblages that have been already detected, is of all others the moſt unſatisfactory in conducting to the knowledge of plants. An herbaceous vegetable is preſented to me which I am to inveſtigate by the method juſt illuſtrated. My firſt enquiry is, whether the plant riſes with one or two ſeed-leaves? The queſtion appears ſimple and eaſy; and yet it is a thouſand to one that I am incapacitated by circumſtances from returning a proper anſwer. For, if the plant has paſſed, though never ſo little, its firſt ſtage of vegetation, ſo that the expanſions of the lobes of the ſeed are no longer viſible, in vain do I look for a ſolution of my query, till its ripened ſeeds have, in germinating, protruded one or two ſeminal leaves ſimilar to thoſe exhibited by itſelf in the infancy of its progreſs. Thus the preſence of both flower and fruit is, in the firſt inſtance, of no avail; and the number of ſeed-leaves muſt abſolutely be recognized, before the plant can be referred to its primary diviſion

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in the method: I ſay, its primary diviſion, becauſe many ſubordinate characters paſs under review previous to the determination of its claſs. The number of ſeed-leaves conſtitutes the firſt diviſion; the preſence or abſence of the petals, the ſecond; the ſimplicity or compoſition of the flowers, the third; the preſence or abſence of a veſſel for containing the ſeeds, the fourth; the number of naked ſeeds, the fifth; the nature of the ſeed-veſſel, the ſixth; the number of petals, the ſeventh. Encumbered with ſuch a multiplicity of characters, many of them not accurately determined, how is it poſſible that the method ſhould be uſeful? As an attempt to inveſtigate the order of nature, its merit is great and conſpicuous. The firſt, third, fourth, ſixth, eleventh, twelfth, thirteenth, fourteenth, ſixteenth, twenty-firſt, twenty-ſecond, and twenty-fifth claſſes, are true natural aſſemblages. In fine, to ſuch as are already maſters of the ſcience of plants, no plan of arrangement affords equal pleaſure with that of Ray. The order of nature, where it could be traced, is carefully pointed out; and the affinities of plants delineated with a maſterly hand. To beauties of this kind the novice in Botany is inſenſible; he requires an eaſy method of inveſtigating plants, and, provided he obtains it, is totally indifferent whether the claſſes are natural or artificial.

The characters of the orders or ſecondary diviſions in Ray's method are no leſs multifarious than thoſe of the claſſes. They reſpect the place of growth of plants, their qualities, the figure of the ſtem, the number, ſituation, ſubſtance and diviſion of the leaves, the ſituation and diſpoſition of the flowers and calix, the number and regularity of the petals, the number and figure of the fruit. In his improved method, Ray has adopted Tournefort's characters of the genera, wherever his plan would permit. His General Hiſtory of Plants contains deſcriptions of 18655 ſpecies

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and varieties. The third volume, which was not publiſhed till 1704, and is deſigned as a ſupplement to the two preceding ones, contains the plants diſcovered by Tournefort in the Levant, and by Camelli at Luzon, one of the Philippine Iſlands. Ray's method was followed by Sir Hans Sloane in his Natural Hiſtory of Jamaica; by Petiver in his Britiſh Herbal; by Dillenius in his Synopſis of Britiſh Plants; and by Martyn in his Catalogue of Plants that grow in the neighbourhood of Cambridge.

To Ray's original method ſucceeded that of Chriſtopher Knaut, a German, which acknowledges the ſame principle, and is manifeſtly founded upon it. In his Enumeration of the plants that grow naturally around Hal in Saxony, publiſhed at Leipſic in 1687, the few vegetables he deſcribes are arranged into ſeventeen claſſes which have for their baſis, the ſize and duration of plants, the preſence or abſence of the petals, the diſpoſition of the flowers, the ſubſtance of the fruit, the number of capſules or ſeeds, the number and figure of the petals, and the preſence, abſence or figure of the calix. After the uſual diſtribution of vegetables into herbs and trees, Knaut proceeds to diſcriminate the former, from the preſence and abſence of the petals. Herbs that are furniſhed with petals he again ſubdivides into ſuch as bear ſimple, and ſuch as bear compound flowers. The former arrange themſelves into nine claſſes, which ſtand diſtinguiſhed by the preſence or abſence of a veſſel for containing the ſeeds. In plants of the firſt claſs, the ſeeds are incloſed in a fleſhy ſucculent veſſel of the berry kind, of which arum, bryony and night-ſhade afford proper examples; in the ſeven claſſes which immediately ſucceed, the caſe or veſſel is dry and membranaceous. The ſecond claſs contains plants with a ſingle capſule or dry ſeed-veſſel, and one petal; and is exemplified in fumitory, gentian, fox-glove, convolvulus and birth-wort. Four regular petals characterize the third claſs, as do four

irregular petals the fourth, which correſpond to the twenty-firſt and twenty-ſecond claſſes of Ray. The fifth, ſixth and ſeventh claſſes contain plants with five, ſix and many petals, and anſwer to the twenty-third and twenty-fourth claſſes of the ſame author. Plants with more than a ſingle capſule conſtitute the eighth claſs, which is exemplified in ſwallow-wort, columbine, aconite, pæony and hellebore, and correſponds to the eighteenth claſs of Ray. All plants having naked ſeeds or wanting a ſeed-veſſel are contained in Knaut's ninth claſs, which conſequently includes the umbelliferous and rough-leaved plants, thoſe with leaves diſpoſed in the form of a radiant ſtar, the lip-flowers and ſeveral others. The compound flowers, which conſtitute the two next claſſes are diſtinguiſhed from the preſence or abſence of the *pappus* or downy crown of the ſeed. In the tenth claſs, which is exemplified in daiſy, feverfew, tanſy, ſcabious, teazel and eryngo, the ſeeds are ſolid, that is, want the crown alluded to; in the eleventh, of which aſter, golden-rod, groundſel, thiſtle, dandelion and nipple-wort furniſh examples, they are crowned with a *pappus* or downy calix. The preceding claſſes exhauſt the diſtribution of herbaceous plants that are furniſhed with petals. In the four following claſſes, which conclude the firſt diviſion of the method, the petals are wanting; and that either ſolely, as in the twelfth and thirteenth, which are exemplified in hop, nettle, mercury, dock and the graſſes; or in conjunction with the calix, as in the fourteenth and fifteenth, which correſpond to the four firſt claſſes in Ray's method; the former containing the ferns; the latter, the moſſes, muſhrooms and ſea-weed. It remains only to be obſerved that woody vegetables, which conſtitute the ſecond grand diviſion, are very unſyſtematically huddled together, as in Ray's original method, into two claſſes, the one including trees, the other ſhrubs.

Such is the general method of Chriſtopher Knaut, which Linnæus very properly terms Ray's original Syſtem inverted. Trees are placed after herbaceous vegetables, petal-wanting herbs after ſuch as are furniſhed with petals, plants with naked ſeeds after ſuch as have the ſeeds contained in a caſe or veſſel, plants with many dry membranaceous ſeed-veſſels after ſuch as are only furniſhed with one, and compound flowers after thoſe which are ſimple. The diſtinction from the lobes of the ſeed Knaut has entirely rejected; as he has likewiſe that of flower-bearing and flower-wanting herbs. On the whole, however, his method is not a whit eaſier or more practicable than that of Ray: the uncertain diſtinction of petal-bearing and petal-wanting flowers is ſtill retained; a multiplicity of ſteps is employed in connecting the claſſes; and if the author has diminiſhed the number of theſe, by thruſting ſeveral into the place of one, he has likewiſe rendered them doubly intricate, by making a variety of ſubdiviſions neceſſary. Plants which bear naked ſeeds occupy ſix claſſes in Ray's improved method: in the method under review they are all referred to one. Much, it may be thought, is gained here in point of facility. A plant with one, two, four or many naked ſeeds is referred at ſight to the ninth claſs in Knaut's method. But although its place in the arrangement is ſo quickly determined, I am not a whit nearer in inveſtigating the plant. For, upon examination, I find, that the ſections or ſubdiviſions of the claſs in queſtion exactly correſpond to the claſſes containing plants with naked ſeeds in Ray's method: ſo that 'tis only ſubſtituting the term *diviſion* for *claſs*, and *claſs* for *ſection* or *ſubdiviſion*, and the two methods are, in this reſpect, exactly the ſame. Thus Knaut, by abridging Ray's method, has neither removed its difficulties, nor rendered it leſs impracticable. The faults of his arrangement, however, are not merely negative. He has entirely effaced the beauty of his original, and deſtroyed its

ſymmetry. The natural claſſes, which conſtitute the chief, perhaps the ſole merit of Ray's ſyſtem, find no place in that of Knaut; and in their ſtead we are preſented with claſſes, which do not compenſate for the want of numerous relations, by poſſeſſing any ſuperior facility in conducting to the knowledge of plants. There is no certain mark of diſtinction betwixt the twelfth and thirteenth claſſes, which contain herbaceous plants that want petals, but have the flower-cup. The fourteenth and fifteenth, which include all the flower-wanting herbs of Ray, are not more accurately diſtinguiſhed. In fine, the copy is greatly inferior to the original, and, indeed, poſſeſſes no great ſhare of merit, either in point of execution or utility.

The ſections or ſubdiviſions of the claſſes in Knaut's method are ſixty-two in number, and ariſe from the figure of the ſtem and petals, the number of capſules and cells, their figure, the number of ſeeds and leaves, and ſituation of the flowers.

Doctor Herman's method, which comes now to be analyſed, is formed, partly on that of Moriſon, partly on that of Ray, and affords as beautiful diſtinctions as any mode of diſtribution hitherto invented. Its author, profeſſor of Botany at Leyden, was the firſt who introduced into Holland a genuine ſyſtematic arrangement of plants from the parts of fructification. Moriſon's method had been left incompleat; and Ray's, though perfect from its firſt appearance, did not all at once attract the attention of the learned, and was indeed for many years ſtudied chiefly in England, the native country of its author. The defects of Ray's original method, and its impracticability, did not elude the obſervation of Herman. He had applied himſelf with unremitting ardour from his earlieſt years to the ſtudy of plants, had examined with attention every plan of arrangement, and actually undertaken

taken a long and perilous expedition into India, with the ſole view of promoting his favourite ſcience. Such a man merited the applauſe of the public, and he obtained it. He was recalled from his expedition, and appointed to ſuperintend the botanical ſchool and garden at Leyden: in the diſcharge of which important office, he exhibited ſuch marks of unwearied diligence, that twice as many plants are ſaid to have been reared by Herman alone, as had been introduced into the garden by all his predeceſſors put together, Bontius, Clutius, Pavius, Cluſius, Vorſtius, Schuylius, and Syenus, in the long ſpace of a hundred and fifty years. Boerhaave relates, that, in 1681, the number of plants in the garden at Leyden amounted to only one thouſand five hundred and thirty-ſeven; and that eight years after they had increaſed, by the induſtry of Herman, to the amazing number of three thouſand and upwards.

THE method propoſed by Herman was firſt publiſhed to the world in 1696, by Zumbac, who arranged according to it the plants demonſtrated by its celebrated author in the public garden. Rudbeckius the younger, in a Diſſertation publiſhed the ſame year on the fundamental knowledge of plants, has adopted Herman's method with a few inconſiderable variations. Laſtly, in 1695, Herman himſelf, fully convinced of the neceſſity of emendations in the primary as well as ſubaltern diviſions, ſet about an accurate edition of his method, in which he had made a very conſiderable progreſs, when death put a final period both to him and his work.

HERMAN'S method conſiſts of twenty-five claſſes, which are founded upon the ſize and duration of plants, the preſence or abſence of the petals and calix, the number of capſules, cells and naked ſeeds, the ſubſtance of the leaves and fruit, the form and con-

conſiſtence of the roots, the ſituation and diſpoſition of the flowers, leaves and calix, and figure of the fruit. After diſtributing all vegetables into herbs and trees, the author proceeds with Knaut to arrange the former into two diviſions, from the preſence or abſence of the petals. Petal-bearing herbs conſtitute the firſt diviſion, and are contained in eighteen claſſes, which ſtand diſtinguiſhed by the abſence or preſence of a veſſel for containing the ſeeds. The firſt ſeven claſſes exhauſt the diviſion of herbaceous plants with naked ſeeds. In the firſt are contained plants whoſe flowers are ſucceeded by ſeveral naked ſeeds that are joined together and form a head. It correſponds to the fifteenth claſs in Ray, and is exemplified in ranunculus and meadow-rue. The umbelliferous plants conſtitute the ſecond claſs, the characteriſtics of which are, two naked ſeeds, and flowers of five petals formed into an umbel. The third and fourth claſſes agree in having a ſingle naked ſeed, but differ in the nature of the flowers, which are ſimple in the former, compound in the latter. This diſtinction has been fully explained already. The fifth claſs, which ſhould have immediately ſucceeded the ſecond, contains plants that have two naked ſeeds, and flowers with one petal. Theſe are the *ſtellatæ* or *ſtar-like* plants of Ray. Four naked ſeeds characterize the two next claſſes, which contain the rough-leaved plants and ſuch as flower at the joints, of the ſame author. Of plants which have their ſeeds contained in a veſſel, ſome bear a membranaceous, ſome a pulpy ſucculent fruit. Membranaceous ſeed-veſſels are either of the capſule or pod kind. Plants with a ſingle capſule are divided from the form of the roots, which, in ſome, are bulbous, in others, not bulbous. Thoſe which arrange themſelves under the latter diviſion are again ſubdivided from the number of cells, caverns or internal cavities of the ſeed-veſſel. In the eighth claſs, the fruit has one cell, in other words, an undivided cavity; in the ninth, there are two cells, in the tenth

three,

three, in the eleventh four, in the twelfth, five or more. The bulbous-rooted plants, which conſtitute the twenty-fourth claſs in Ray's method, are very improperly disjoined by Herman from the diviſion to which they belong, and transferred to the ſixteenth claſs, where they are perfectly ſolitary, and maintain no ſort of connection with any of the plants in their neighbourhood. Herbs with many capſules are all contained in the thirteenth claſs which correſponds to the eighteenth in Ray. The fourteenth and fifteenth claſſes contain plants with a dry membranaceous ſeed-veſſel of the pod kind; the former includes the croſs-ſhaped, the latter the butter-fly-ſhaped or pea-bloom flowers of later botaniſts. Herbs with a pulpy fruit form the ſeventeenth and eighteenth claſſes, which ſtand diſtinguiſhed, as in Ray, from the covering of the pulp, which, in the former, is thin and ſlender, in the latter, coarſe and thick.

Such are the diſtinctions of petal-bearing herbs adopted by Herman. Herbs which want petals are contained in the three following claſſes, and arrange themſelves, as in Knaut, from the abſence of that organ alone, or of both calix and petals. The nineteenth claſs conſiſts of herbaceous plants which want the petals, but are furniſhed with a flower-cup properly ſo called. It is exemplified in rhubarb, dock, ſpinach, and plantain. In the twentiéth claſs, which contains the ferns, and ſome herbaceous plants, whoſe flowers grow in catkins, both calix and petals are wanting. The twenty-firſt includes the graſſes, and ſuch plants as have an affinity to them. They are diſtinguiſhed from thoſe of the two preceding claſſes, by the preſence of a *gluma* or huſky calix. In Knaut's method, the graſſes are very improperly thruſt into a claſs with plants to which they have no affinity: ſo that an accurate characteriſtical mark cannot be aſſigned for diſcriminating the two claſſes of plants that want the petals. In the

method

method under review, the graſſes being aſſigned a ſeparate claſs, are accurately diſtinguiſhed from all other plants that want petals, by the nature of their flower-cup, which is of that kind termed a *gluma* or huſk; whilſt the preſence of a cup, without reſpect to its nature, ſerves effectually to diſtinguiſh them from the ferns, moſſes, and ſuch other plants as have neither calix nor petals.

In ſubdividing trees and ſhrubs, Herman has greatly improved upon Ray. The twenty-ſecond claſs conſiſts of trees whoſe flowers want petals and grow in catkins. It correſponds to the twenty-eighth claſs in Ray's method, the plants of which, as the reader will remember, have the flower placed at a diſtance from the fruit. To this claſs Herman has referred the tribe of palms, which occupy a whole diviſion in Ray. Trees with a pulpy umbilicated fruit conſtitute the twenty-third claſs, under which is arranged the fig, by Ray placed in the appendix to his method, from its ſingularity in concealing the flowers within the fruit. The twenty-fourth claſs conſiſts of trees with pulpy fruits which are ſupported, not crowned by the calix: the twenty-fifth of ſuch as have a dry membranaceous ſeed-veſſel. The former correſponds to the thirtieth; the latter to the thirty-firſt and thirty-ſecond claſſes in Ray's method, which improperly disjoined trees with dry ſeed-veſſels of the pod kind from ſuch as have a dry membranaceous fruit of another form.

By attending to the analyſis juſt given, the reader cannot fail to obſerve, that the method propoſed by Herman excels all which preceded it, in the uniformity of its claſſical characters. The author ſet out with the fruit for his principle, and has adhered more cloſely to it than either Moriſon, Ray or Knaut. In the firſt eighteen claſſes, the number of naked ſeeds, the nature of the different ſeed-veſſels, and the number of cells or internal cavities

cavities of the fruit furniſh the ſole diſtinction. No ſuch uniformity characterizes the methods of the ſyſtematical writers juſt mentioned. Ray and Knaut have ſubdivided that branch of their reſpective methods which contains plants having a dry membranaceous ſeed-veſſel, from the number of petals; Herman from the number of cells or cavities of the fruit. The tranſition from the ſeed-veſſel to the petals is unnatural, becauſe the latter precede the former: the tranſition from the ſeed-veſſel to its internal diviſions is in the true ſpirit of ſyſtematic arrangement, which, attaching itſelf to one particular part, is ſtudious to exhibit it, for the purpoſe of diſcriminating bodies, under every poſſible point of view. Herman's ſuperiority in this reſpect is indiſputable. Even the diſtinction of ſimple and compound flowers he has rendered ſubordinate to the principle with which his method ſets out, and, inſtead of employing it, as Ray and Knaut have done, in diſcriminating all flower-bearing plants that are furniſhed with petals, has reſtricted it to the diſtinguiſhing of two claſſes, thoſe, to wit, containing plants whoſe flowers are ſucceeded by a ſingle naked ſeed. But though, by this improvement, Herman has rendered his method more uniform, he has added nothing to its facility. In fact, the number of naked ſeeds is a very equivocal character when employed in diſtinguiſhing compound flowers, which we may as properly arrange with Cæſalpinus among plants that bear many naked ſeeds, as with Herman among ſuch as bear but one; the former reſpecting the aggregate, the latter, each particular floret of which it is compoſed.

The diſtinction of naked and covered ſeeds makes a very principal figure in all the methods founded upon the fruit, particularly in thoſe of Ray, Knaut, and Herman. Yet, ſtrange as it may ſeem, there is no characteriſtical mark that, in all caſes, ſhall, with accuracy, diſtinguiſh the one from the other. Whatever,

when ripe, detaches itſelf from the mother-plant ſpontaneouſly and ſingly, is denominated by Mr. Ray a naked ſeed. He adds that, in dubious caſes, we are always to be determined by the ſtructure of the plants of the ſame natural claſs. Thus, continues my author, in leguminous plants with a ſingle ſeed, and ſome others that bear ſmall pods of the *ſiliqua* kind, the fruit falls off from the parent plant without ſplitting, and diſperſing the incloſed ſeeds. Yet is not the whole ſubſtance ſo detached to be deemed a naked ſeed; why? becauſe moſt of the plants which have nearest affinity to thoſe in queſtion are confeſſedly furniſhed with a ſeed-veſſel that is either replete with numerous ſeeds, or, if it contains but one, is found to open ſpontaneouſly, when ripe, with a view to expel it. The truth of this concluſion I allow, but deny its utility. A novice in Botany, and it is to ſuch an one that every plan of arrangement ought to accommodate itſelf, will be little benefited by the diſtinction juſt mentioned. His object is to inveſtigate plants by a method of arrangement, the principles of which he comprehends. He underſtands the terms *naked* and *covered* ſeeds, in the general ſenſe expreſſed in their definition; he expects that the meaning of words ſhould never be violated; that they ſhould, at firſt, be defined with a logical exactneſs, nor be ever made to convey any other ſenſe than that with which they were originally impreſſed. He is ſuppoſed to be totally ignorant, not of the plant in queſtion only, but of all ſuch as bear affinity to it: how then, in doubtful caſes, ſhall Mr. Ray's rule be applied? He is to be determined by the plants of the ſame natural claſs; but thoſe plants are unknown to him: he muſt depend then entirely upon the rectitude of the definition, which, as we have ſeen, is evidently calculated to bewilder and miſlead. I decline ſtretching this criticiſm to its utmoſt extent, and ſhall only obſerve that, as no characteriſtical mark has hitherto been aſcertained, which, in all caſes, ſhall diſcriminate *naked* from

covered

covered ſeeds, the diſtinction, far from having infallibility aſcribed to it, ought, in my opinion, to be employed with no leſs reſerve than that derived from the preſence or abſence of the petals. An ingenious botaniſt of the preſent century, whoſe tenets I ſhall have occaſion in the ſequel to diſcuſs, has not ſcrupled to deny the exiſtence of naked ſeeds, and of conſequence, the reality of the diſtinction before us. I will not at preſent enter largely into the merits of this paradoxical dogma, which I am clearly of opinion owed its origin to miſtaken notions of the analogy that ſubſiſts between plants and animals. Seed-veſſels or receptacles of the ſeeds are in the vegetable kingdom what the *uterus* of vipiparous animals, is in the animal. The ſeeds contained in the caſe or veſſel correſpond to the fœtus incloſed in the *uterus*. Perhaps, the author juſt alluded to, may have extended the analogy to oviparous animals, and even to ſuch in which the proceſs of generation is leſs accurately diſcerned. His mode of reaſoning then has probably been as follows: ſeed-veſſels are confeſſedly analogous to the *uterus* of animals; now all animals are furniſhed with an *uterus*, or ſome organ which performs its functions; therefore all plants are furniſhed with a ſeed-veſſel for incloſing and nouriſhing the vegetable fœtus. This propoſition, however, is not logically true, becauſe neither the major nor minor have been demonſtrated ſuch. Indeed, if the analogy contended for could be fully proved, and all animals demonſtrated to be furniſhed with an *uterus*, I ſhould think the conſequence infallibly certain: but as neither of theſe has been attempted, and both major and minor are entirely hypothetical, the ſyllogiſm is falſe, and the concluſion or inference erroneous. That the analogy does not hold good in every caſe, is indiſputable. I ſhall allow that the ſeed-veſſels of plants which gape and expel the ſeeds, may be thought analogous to the *uterus* of viviparous animals: and the ſeeds ſo expelled with their proper teguments to the

animal fœtus that is protruded with its coverings. But is this analogy univerſal? Do the ſeed-veſſels of all plants ſplit when ripe, for the purpoſe of expelling their ſeeds? The contrary is indubitable. Pulpy fruits of the apple, berry and cherry kind neither ſplit when ripe, nor adhere to the plant, as the uterus always does to the animal, but detach themſelves from it with the incloſed ſeeds. Again, ſeed-veſſels which ſplit when ripe, and adhere to the plant after the diſperſion of their ſeeds, ceaſe to be uſeful in vegetation. They are temporary parts deſtined to incloſe and expel the ſeeds. Their nature admits not of a ſecond fecundation; they have been once fruitful; they have expelled their ſeeds; the end of their deſtination is accompliſhed; they wither, moulder and rot. How ſtriking the diſparity in animals! The female *uterus* is no temporary part, nor limited to a ſingle fecundation. It is coeval, ſubſiſts and dies, with the animal; and is deſtined to perform, not once, but frequently, its valuable functions of incloſing and nouriſhing the tender fœtus.

From this digreſſion, which the main ſubject afforded me, I return to mention ſome improprieties committed by Herman in the execution of his plan. The firſt ſeven claſſes contain plants with one or more naked ſeeds: but inſtead of beginning with the moſt ſimple, and proceeding to the more complex, Herman ſcarce obſerves any order in their arrangement, ſave that ſuggeſted by the conveniency of demonſtration. Plants with many naked ſeeds occupy the firſt claſs, becauſe they produce their flowers very early in the ſpring. Next come the umbelliferous plants, which bear two naked ſeeds; then the ſimple and compound flowers with one; to theſe ſucceed the plants with leaves diſpoſed like a radiant ſtar, which, like the umbelliferous plants, bear two; and laſtly, the rough-leaved plants and ſuch as flower at the joints, whoſe characteriſtic is four naked ſeeds. Rudbeckius,

beckius, in his edition of Herman's method, has removed the impropriety complained of, by beginning with the moſt ſimple claſſes, thoſe, to wit, whoſe plants bear a ſingle naked ſeed, and proceeding by degrees to ſuch as are more complex, that is, have plants with two, four or many ſeeds. With the plants of the firſt claſs, Herman, after Ray, has improperly arranged thoſe of the mallow tribe, which producing, not a number of naked ſeeds, but a capſular fruit divided into ſeveral cells, ought unqueſtionably to be referred to the twelfth claſs, with the characteriſtics of which the plants in queſtion agree. Scarce any of the plants of the third claſs, which correſponds to the tenth of Ray, are found to poſſeſs the claſſical character, a ſingle naked ſeed. In all the ſpecies of valerian, the flower is ſucceeded by a ſtreaked capſule, which in ſome is leſs conſpicuous, in others, thick and hard as a cruſt; and, in a particular ſpecies, furniſhed with two cells, one of which is generally empty. Marvel of Peru has its ſingle ſeed covered with a huſk or outer coat, which may be eaſily ſtripped off, if not over-dried. Enchanter's night-ſhade is furniſhed with a capſule that has two cells, each containing a ſingle ſeed. Fumatory has a ſmall undivided pod of the *ſiliqua* kind; agrimony two naked ſeeds lodged in the bottom of the calix. Some of the other claſſes with naked ſeeds are liable to exceptions of the like kind. What Herman and Ray denominate two naked ſeeds in the plants whoſe leaves are diſpoſed in the form of a ſtar, Linnæus, with much greater propriety, terms a twinberry of a dry ſubſtance, incloſing two ſeeds. Looſe-ſtrife has a capſular fruit with an undivided cavity, and therefore ought not to be arranged with the plants of the ninth claſs, the characteriſtic of which is a capſule with two internal diviſions or cells. Gentian, leſſer centaury and ſaxifrage, are to be excluded for the ſame reaſon. Some ſpecies of hypericum have one, ſome two, ſome five cells; yet are they all placed without diſtinction in

Herman's

Herman's tenth claſs, which includes ſuch capſular fruits as are divided internally into three cavities or cells. To the ſame claſs are improperly referred the violet, cardinal flower, and ſheep-ſcabious, the firſt of which has an undivided cavity, the others, a capſule with two cells. Graſs of Parnaſſus has one cell, winter-green five, and aſarabacca ſix. In fact, except greek valerian, rampions, and bind-weed, there are none of the plants in the tenth claſs that agree in the general character; nor thoſe always neither; the fruit of bind-weed being ſometimes entire or undivided within. Thorn-apple and rue are referred to the eleventh claſs, which contains capſular fruits with four cells, altho' the former has always two, and the latter, except in one ſpecies, always five cells. Poppy and prickly poppy have an undivided cavity, and therefore do not pertain to the twelfth claſs, the fruits of which are divided into five or more cells. Many more improprieties of a ſimilar nature might be mentioned; but I forbear entering farther into the merits of the method before us, becauſe the inſtances already given are ſufficient to evince, that the execution is greatly inferior to the plan.

The claſſes in Herman's method are ſubdivided into eighty-two ſections or orders, which have for their baſis the number of petals, ſeeds, capſules and cells, the figure of the ſeeds and petals, and diſpoſition of the flowers. The ſecond, fifth, ſixth and ſeventh claſſes are true natural families.

Our review of methods founded on the fruit cloſes with that of the celebrated Dr. Herman Boerhaave, who, ſucceeding to the botanical chair at Leyden in 1709, ſpared no endeavours to preſerve among his countrymen that love for the ſcience of plants which his predeceſſor, Herman, had happily introduced. His method is that of Herman, combined with part of the methods

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of Tournefort and Ray. The ſubmarine and imperfect plants, which find no place in the ſyſtem of Herman, are borrowed by Boerhaave from that of Ray. To collect as many natural claſſes as poſſible, he has likewiſe adopted the diſtinction firſt ſuggeſted by the ſame author from the number of ſeed-lobes or ſeminal leaves. The compound flowers form four claſſes, which derive their characters partly from Ray, partly from Tournefort. Laſtly, trees are diſtributed, as in the latter writer, from the flower, not as in Ray and Herman, from the fruit. It deſerves to be remarked, that Boerhaave, to avoid confuſion, has claſſed all trees and ſhrubs which bear butter-fly-ſhaped flowers with ſuch herbaceous plants as have flowers of the ſame figure. Tournefort, by retaining the ancient diſtinction into herbs and trees, and characteriſing both by the figure of the petals, has been led to inſtitute ſeveral claſſes which, agreeing with others both in the general character and title, ought to be excluded as ſuperfluous. In Boerhaave's method, which is founded partly on the fruit, partly on the flower, an agreement of characters in different claſſes was leſs to be apprehended. The pea-bloom flowers, in fact, appeared to the author the only plants from whoſe ſeparation could ariſe claſſes with ſimilar characters. He has therefore preſerved the family entire, and arranged the papilionaceous trees with the papilionaceous herbs. For my own part, I cannot approve of this junction, as I profeſs myſelf inſenſible of the danger which the ingenious author was ſo ſtudious to avoid. Herbaceous plants with a pea-bloom flower are arranged by Boerhaave after Herman and Ray, not from the figure of the flower, but from the nature of the fruit, which is that kind of pod termed a *legumen*. Trees then with pea-bloom flowers might have formed another claſs, the characteriſtic of which being the figure of the flower, and not the ſubſtance or figure of the fruit, rendered it impoſſible to confound the plants in queſtion with thoſe of the herbaceous

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kind juſt mentioned. Upon the whole, Boerhaave ought either to have rejected the diſtinction into herbs and trees altogether, or to have retained it entire. By placing leguminous trees in the ſame claſs with leguminous herbs, he has diſcovered a want of attention to the main purpoſe of ſyſtematic arrangement, and precipitately encountered a real danger, in order to avoid an imaginary inconvenience.

BOERHAAVE's claſſes are thirty-four in number, and ſubdivide themſelves into a hundred and four ſections, which have for their characters, the figure of the leaves, ſtem, calix, petals and ſeeds; the number of petals, ſeeds and capſules; the ſubſtance of the leaves; the ſituation of the flowers and their difference in point of ſex. By this method Boerhaave arranged near ſix thouſand plants, the produce of the botanical garden at Leyden, which he carefully ſuperintended for the ſpace of twenty years, and left to his ſucceſſor, Dr. Adrien Royen, in a much more flouriſhing ſtate than he had himſelf received it. His Index or Catalogue of the Leyden plants was publiſhed in octavo in 1710, and afterwards, with great additions, in quarto in 1720. This laſt edition contains deſcriptions of five thouſand, ſix hundred and fifty plants, of which number upwards of two thirds had been introduced into the garden ſince the time of Herman, by the induſtry of his illuſtrious ſucceſſor. Boerhaave's characters are derived from the habit or general appearance of plants combined with all the parts of fructification; ſo that, as Linnæus very properly obſerves, he was the firſt who employed the calix, ſtamina and ſtyle in determining the genus. About ſeventeen new genera were eſtabliſhed by this author; among others, the very ſplendid family of the *protea* and ſilver-tree, which, although partly deſcribed by Moriſon, had remained generally unknown till the period now under review. His method was adopted by one Ernſting,

Ernſting, a German, in a treatiſe entitled, The firſt Principles of Botany, publiſhed in octavo, at Wolfenbuttel, in 1748. To detect the order of nature, not to diſcover an eaſy plan of arrangement, ſeems to have been the darling object of Boerhaave; in attaining which, however, he has been ſo little ſucceſsful, that, of the four-and-thirty claſſes which compoſe his difficult and complicated method, no more than eight can be reckoned true natural aſſemblages. Theſe are the claſſes containing the ferns; the umbelliferous and rough-leaved plants; thoſe which flower at the joints and have leaves diſpoſed at proper intervals round the ſtem in form of a radiant ſtar; the croſs-ſhaped and pea-bloom flowers; and the diviſion of compound flowers with flat petals, and a lacteſcent or milky ſtalk. The other claſſes are purely artificial, and contain plants which, not poſſeſſing numerous relations, are approximated only by their agreement in the ſingle mark that characterizes the claſs.

The inconveniencies which attend every mode of arrangement founded upon the fruit have already been mentioned: and if the reader has carefully peruſed the preceding part of this ſection, he will not only readily acknowledge their exiſtence, but be apt to wonder that with imperfections, ſuch as thoſe I have recorded, a ſeries of methods ſhould have continued in eſtimation ſo long. In fact, to the writers, whoſe works we have been examining, the novice in Botany is little obliged. Solicitous to collect the affinities of plants, to inveſtigate the order of nature, and diſcriminate her numerous aſſemblages, they forgot that the main purpoſe of ſyſtem is to facilitate to others the knowledge of the objects about which it is converſant. To maſters of the ſcience their reſearches afford the higheſt intellectual entertainment: whilſt to the beginning botaniſt they are equally ſparing of information and delight. The rage which ſo long ſubſiſted

for diſcovering the philoſopher's ſtone proved beneficial to chemiſtry, by caſually enriching it with ſeveral valuable diſcoveries; the paſſion for inveſtigating a natural method in Botany was productive of a quite contrary effect, and had well nigh annihilated the ſcience which it was meant to aggrandize and improve. Blinded by the prevailing prejudice, each ſucceeding writer adopted the errors of his predeceſſor; and no one could be found poſſeſſed of ſufficient courage to venture upon an unbeaten path, even if genius had adminiſtered the proper aſſiſtance in pointing it out. Each walked in the track marked out for him by another. Moriſon followed Cæſalpinus; Ray improved upon Moriſon; Knaut abridged Ray; Herman formed himſelf partly on Moriſon, partly on Ray; Boerhaave makes Herman his guide, and calls in Ray and Tournefort as auxiliaries. Auguſtus Quirinus Rivinus, a German, Profeſſor of Botany at Leipſic, was the firſt who, in 1690, relinquiſhing the purſuit of affinities, and convinced of the inſufficiency of the fruit, ſet about a method which ſhould atone, by its facility, for the want of numerous relations, and natural families. A method purely artificial appeared to Rivinus the beſt adapted for the purpoſe of vegetable arrangement. He ſaw in all their magnitude the imperfections of thoſe methods which, ſetting out with the profeſſed deſign of detecting the order of nature, had accompliſhed but half their aim. He reſolved to profit by the errors of his predeceſſors, not blindly to adopt them; and rejecting the fruit which had proved an inſufficient principle, and the ſource of numberleſs imperfections, he attached himſelf to the flower, which he was ſenſible furniſhed characters no leſs numerous, permanent and conſpicuous than thoſe of the fruit. In the methods that have been already analyſed, the reader will have obſerved that the ſeed-veſſel and ſeeds, the two conſtituent parts of the fruit, were employed in conjunction. Perhaps either does not furniſh ſufficient variety of characters to

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ſerve ſingly as the foundation of a method. Be that as it may, the parts of the flower lie under no imputation of this kind. The calix, petals, ſtamina and ſtyle or pointal, which conſtitute the flower, are each ſufficiently diverſified in point of number, figure, proportion and ſituation to ſerve as the baſis of a mode of arrangement; yet all are not equally proper for that purpoſe. Rivinus made choice of the petals as the largeſt and moſt beautiful part, and that from which the flower itſelf is vulgarly characterized. His method conſiſts of eighteen claſſes, which have for their baſis the perfection and diſpoſition of the flowers, and regularity and number of the petals.

As Rivinus ſet out with the profeſſed deſign of imparting facility to Botany, he judged very properly in diveſting his method of all extraneous matter, and rendering it as ſimple and uniform as the nature of the ſcience would admit. The diſtinction into herbs and trees had been adopted by every writer on plants ſince the time of Ariſtotle. Rendered, in ſome meaſure, ſacred, by its antiquity, it long maintained a conſequence which had better befitted characters leſs inſufficient, and more clearly aſcertained. Rivinus was the firſt who in this matter dared to think for himſelf; he was early ſenſible of the inconveniencies to which thoſe had ſubmitted who employed it as a primary diviſion; he reſolved therefore at once to get rid of a diſtinction that is frequently uncertain, always deſtructive of uniformity, and in its nature repugnant to the genuine ſpirit of ſyſtem, becauſe totally unconnected with the parts of fructification. His reaſons for this laudable, but unprecedented ſtep, he has delivered with great preciſion in a letter addreſſed to Mr. Ray, ſoon after the publication of his method, in which likewiſe the propriety of the aforeſaid diſtinction is fully handled.

The method now before us opens with a diviſion from the preſence of the petals and calix, and abſence of either or both. Flowers that are furniſhed with both the organs in queſtion, are ſaid, in the language of Rivinus, to be perfect or compleat; thoſe which want either or both are denominated imperfect or incompleat. This diſtinction was formerly hinted at, and its ſuperiority above that derived from the preſence or abſence of the petals alone fully proved. Perfect flowers, which occupy the firſt ſeventeen claſſes, are ſubdivided into a double phalanx, the one containing ſimple, the other compound flowers. It would be unneceſſary to enlarge upon this diſtinction, as the reader who has peruſed Ray's method with attention, will be at no loſs for its diſcriminating character. Simple flowers ſubdivide themſelves into ſuch as are regular, and ſuch as are irregular. Regular flowers are defined by Junigus, Ray and Chriſtian Knaut, to be ſuch whoſe petals agree, not ſo much in magnitude, as in figure and ſituation. Rivinus's idea is different. The petals, or diviſions of the petal, if there is but one, muſt correſpond not in figure and ſituation only, but alſo in ſize; in one word, they muſt be every way equal. Nor is this all. Other characters are required to be preſent, in order to conſtitute the flower ſtrictly regular. The ſtyle is to iſſue from the center of the flower; the calix to have its diviſions equal, and the ſtamina to be proportionable in number to the petals or their diviſions. This firſt part of the method then forms two branches, which are each ſubdivided from the number of petals into ſeven claſſes that have the ſame characters and title, and differ only in the equality or inequality of the flowers. We begin with the regular flowers, which occupy the firſt ſeven claſſes. Plants of the firſt claſs have regular flowers of one petal. It is exemplified in marvel of Peru, madder, borrage, hound's-tongue, mallow, hyacinth, water-leaf and ſwallow-wort. The ſecond claſs contains only one genus, enchanter's night-ſhade, which bears regular

gular flowers with two petals. Flowering-ruſh, frog's-bit and water-plantain, afford examples of the third claſs, whoſe characteriſtic is three regular petals. The fourth and fifth claſſes are numerous, and contain plants with four and five regular petals. Poppy, barren-wort and the croſs-ſhaped flowers arrange themſelves under the former; ſaxifrage, ranunculus, myrtle, columbine, with ſeveral others under the latter. The ſixth claſs conſiſts of flowers with ſix regular petals, and is exemplified in moſt of the liliaceous or bulbous-rooted plants. More petals than ſix, and a regular flower characterize the ſeventh claſs, of which adonis, anemone and ficoides afford proper examples. The irregular flowers with one petal are exemplified in ſage, roſemary and the other lip-flowers. Thoſe with four petals are the papilionaceous or pea-bloom flowers of later botaniſts. The umbelliferous plants with ſome others, particularly aconite, lark-ſpur, violet and fraxinella occupy the claſs containing flowers with five irregular petals. Irregular flowers with ſix petals are exemplified in orchis, ladies-ſlipper and honey-flower. The claſſes deſtined for containing plants with irregular flowers of three and many petals, were inſerted in order to render the plan of arrangement compleat: for neither Rivinus, nor Heucher, who publiſhed the greateſt part of his method, were acquainted with any plants that could arrange themſelves under either of theſe claſſes. Two genera only pertain to the claſs of irregular flowers with two petals. The compound flowers are very improperly interjected by Rivinus betwixt the regular and irregular ſimple flowers, and occupy three claſſes, which ſtand diſtinguiſhed from the regularity and irregularity of the florets of which the aggregate is compoſed. In the firſt claſs, which is the eighth of the method, the florets are all regular and equal. Globe-thiſtle, globe-amaranth, centaury, burdock, eryngo and water-lilly are adduced as examples. This claſs correſponds to part of the *capitatæ* of Ray,

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and to the compound flowers with hollow florets of Tournefort. The ſecond claſs is compoſed of florets that are partly regular partly irregular, and is exemplified in ſun-flower, daiſy, and the other radiated flowers of the French botaniſt, which have hollow regular florets in the center or diſk, and flat irregular ones in the circumference, margin or ray. In the third claſs, the florets are all of an irregular figure, being hollow at the baſe, and flat above. The plants which compoſe it correſpond to the compound flowers with flat petals and a milky ſtalk of Ray, and to thoſe with ſemi-florets of Tournefort. There remains but one claſs, the eighteenth, containing all the plants by Rivinus termed imperfect, that is, which have none or only one of the covers preſent. Theſe are the cone-bearing plants, thoſe whoſe flowers grow in catkins, the graſſes, the ferns, moſſes, muſhrooms and ſome others.

Such is the ſyſtem of Rivinus from the equality and number of the petals: a ſyſtem, no leſs admired for its ſimplicity, than for the regularity and uniformity of its plan. Its facility in conducting to the knowledge of plants will beſt appear by an example. I am required to refer a plant of the common mallow to its proper claſs in Rivinus's method. The preſence of both calix and petals excludes it at once from the eighteenth claſs, the characteriſtic of which is the abſence of one or both. My next enquiry is, whether the plant in queſtion pertains to the diviſion of ſimple or compound flowers? This, from my knowledge of the diſtinctive character, is immediately anſwered, and the plant referred at ſight to the former branch of the method. By this ſtep the three claſſes containing compound flowers are cut off, and my plant is adjudged to belong to one of the fourteen claſſes of the perfect, ſimple flowers which remain. I next examine the diviſions of the flower, and finding them to be equal, not only in ſituation and figure, but alſo in ſize, I refer the plant to

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the diviſion containing regular flowers, which occupy the firſt ſeven claſſes of the method. The number of petals next claims my attention: and here I muſt be particularly cautious not to confound plants of one claſs with thoſe of another. For it frequently happens that flowers with only one petal are ſo deeply divided, that to a careleſs or ſuperficial obſerver they appear compoſed of many petals. Rivinus's rule on this head is in general a good one. It is to reckon as many petals, as the flower reſolves itſelf into, when fallen. The reader, however, is not to imagine, that in every caſe we are to wait for this criterion. It is only meant as a guide where the diviſions of the flower are ſo deep that a doubt may well ariſe to what branch of the method the plant in queſtion ſhould be referred. In moſt caſes, we can determine at ſight whether the flower is compoſed of one or more petals. If the diviſions only reach the middle of the flower, or occupy the upper ſpreading part, without extending to the tube or hollow part below, there is no doubt, the flower is manifeſtly of one petal, and arranges accordingly. If, on the other hand, the diviſions reach the bottom of the flower, and do not adhere, even in the ſlighteſt degree, but appear each, by their ſimilar conformation, to be totally diſtinct, and actually reſolve themſelves, on the falling of the flower, into as many ſeparate parts as there were diviſions when it remained upon the plant, the flower is manifeſtly compoſed of many petals, and muſt be referred to its correſponding diviſion in the method. The former characters are generally ſufficient to determine this: it is only, as we have ſaid, in doubtful caſes, that Rivinus's rule is to be applied. Neither indeed is the rule in queſtion infallible: for though by it ſeveral plants, particularly wood-ſorrel, ledum, pimpernel and *trientalis*, are very properly adjudged to have but one petal, from the diviſions being found to adhere, in falling off; yet ſhould we commit a manifeſt impropriety by referring to a claſs with four

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Such is the ſyſtem of Rivinus from the equality and number of the petals: a ſyſtem, no leſs admired for its ſimplicity, than for the regularity and uniformity of its plan. Its facility in conducting to the knowledge of plants will beſt appear by an example. I am required to refer a plant of the common mallow to its proper claſs in Rivinus's method. The preſence of both calix and petals excludes it at once from the eighteenth claſs, the characteriſtic of which is the abſence of one or both. My next enquiry is, whether the plant in queſtion pertains to the diviſion of ſimple or compound flowers? This, from my knowledge of the diſtinctive character, is immediately anſwered, and the plant referred at ſight to the former branch of the method. By this ſtep the three claſſes containing compound flowers are cut off, and my plant is adjudged to belong to one of the fourteen claſſes of the perfect, ſimple flowers which remain. I next examine the diviſions of the flower, and finding them to be equal, not only in ſituation and figure, but alſo in ſize, I refer the plant to

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the diviſion containing regular flowers, which occupy the firſt ſeven claſſes of the method. The number of petals next claims my attention: and here I muſt be particularly cautious not to confound plants of one claſs with thoſe of another. For it frequently happens that flowers with only one petal are ſo deeply divided, that to a careleſs or ſuperficial obſerver they appear compoſed of many petals. Rivinus's rule on this head is in general a good one. It is to reckon as many petals, as the flower reſolves itſelf into, when fallen. The reader, however, is not to imagine, that in every caſe we are to wait for this criterion. It is only meant as a guide where the diviſions of the flower are ſo deep that a doubt may well ariſe to what branch of the method the plant in queſtion ſhould be referred. In moſt caſes, we can determine at ſight whether the flower is compoſed of one or more petals. If the diviſions only reach the middle of the flower, or occupy the upper ſpreading part, without extending to the tube or hollow part below, there is no doubt, the flower is manifeſtly of one petal, and arranges accordingly. If, on the other hand, the diviſions reach the bottom of the flower, and do not adhere, even in the ſlighteſt degree, but appear each, by their ſimilar conformation, to be totally diſtinct, and actually reſolve themſelves, on the falling of the flower, into as many ſeparate parts as there were diviſions when it remained upon the plant, the flower is manifeſtly compoſed of many petals, and muſt be referred to its correſponding diviſion in the method. The former characters are generally ſufficient to determine this: it is only, as we have ſaid, in doubtful caſes, that Rivinus's rule is to be applied. Neither indeed is the rule in queſtion infallible: for though by it ſeveral plants, particularly wood-ſorrel, ledum, pimpernel and *trientalis*, are very properly adjudged to have but one petal, from the diviſions being found to adhere, in falling off; yet ſhould we commit a manifeſt impropriety by referring to a claſs with four

four petals the flowers of *vaccinium oxycoccus*, which, however, reſolve themſelves, on falling off the plant, into four diſtinct leaves. I am not even certain, whether in the example before us, which has furniſhed matter of controverſy on this head, the rule juſt mentioned can determine with preciſion. Rivinus and Tournefort arrange plants of the mallow tribe with ſuch as bear flowers of one petal. Linnæus, in his *Genera Plantarum*, has aſſigned to each five diſtinct petals. For my own part, I muſt confeſs that I lean to the opinion of the two former botaniſts, not only becauſe I could produce ſeveral inſtances of flowers confeſſedly of one petal, in which the ſegments or diviſions are equally deep with theſe of the mallow tribe; but alſo becauſe the ſegments are rounded, not pointed at the baſe, where they likewiſe manifeſtly cohere. Since I am upon this ſubject, I cannot help remarking a very beautiful diſtinction between flowers of one and many petals, not known to Rivinus. It ariſes from the ſituation of the ſtamina, which, in flowers of more petals than one, are inſerted into the receptacle or ſummit of the footſtalk; in thoſe of one, into ſome part of the petal. M. Vaillant, an ingenious French academician, was the firſt who made this obſervation, ſo far as it reſpects flowers of one petal: and Pontedera is ſaid to have diſſected two thouſand different ſpecies with a view to eſtabliſh its univerſality. By this rule, the flowers of *trientalis* and wood-ſorrel are determined to have only one petal, although the diviſions, which are ſeven in the former, and five in the latter, cohere ſo ſlightly at the baſe, that, without ſuch a mark of diſtinction as that I have mentioned, we ſhould be at a loſs whether to arrange the plants in queſtion, at ſight, with ſuch as bear flowers of one or more petals. I do not, however, mean to inſinuate that Pontedera's rule is a whit more infallible than that of Rivinus. On the contrary, I am ſenſible that, like every general rule, it admits of exceptions; and that it were equally raſh to conclude every flower

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monopetalous which has the ſtamina attached to it, as to arrange among ſuch as have more petals than one all flowers that, in detaching themſelves from the plant, are reſolved into two, three, four or more diſtinct pieces. In ſea-pink, and the genus *melanthium*, the ſtamina are inſerted into the petals, which are five in the former, ſix in the latter. Lychnis, ſilene, roſe-campion, and ſome others of Linnæus's natural order, *caryophyllæi*, have the ſtamina alternately inſerted into the claws of the petals, which are five in number. In theſe plants the number of ſtamina is ten; ſo that one half is attached to the receptacle or ſeat of the flower, and the other half to the petals. Again, there are inſtances of flowers with one petal, which have not the ſtamina attached to their ſubſtance. Of this kind are aloe, and *ciſſus*; as alſo azalea, arbutus, *ledum*, andromeda, heath, and the other flowers of Linnæus's natural order, *bicornes*, ſo termed from the *antheræ* or tops of the ſtamina exhibiting an appearance like two horns. To return to the illuſtration of Rivinus's method. The reaſons mentioned above having determined me to regard the flowers of mallow as monopetalous, that is, compoſed of a ſingle petal, its place among the ſimple regular flowers no longer remains a ſecret. Theſe occupy, as we have ſaid, the firſt ſeven claſſes, which ſtand diſtinguiſhed from the number of petals. To the ſecond, third, fourth, fifth, ſixth and ſeventh my plant cannot be referred, becauſe in theſe the characteriſtic is two or more petals. There remains only the firſt claſs, which conſiſting of regular flowers with one petal, muſt conſequently include the plants of the mallow-tribe, whoſe flowers we have ſhewn to be perfect, ſimple, regular, and monopetalous.

It has been ſaid that Rivinus's method, ſimple and uniform as it is, muſt, if ſtrictly followed, be productive of an almoſt continual violence to nature, by disjoining things which were

never meant to be ſeparated, and confounding others which are in themſelves totally diſtinct. I am admoniſhed that not only different genera of the ſame natural claſs, but likewiſe different ſpecies of the ſame natural genus are exceedingly diverſified with reſpect to the regularity and number of the petals; and that, conſequently, characters derived from theſe circumſtances muſt be of all others the moſt improper, from their manifeſt tendency to confound. This concluſion I deny, yet allow the truth of the affirmation from which it is deduced. In methods purely artificial, the principal object is to arrange plants in an eaſy ſimple manner. Regardleſs of their affinities, ſuch methods are ſolicitous only to conduct with facility to their knowledge. Natural genera, no more than natural claſſes, muſt be preſerved entire, in direct contradiction to the principles of the method. Theſe are to be obſerved in all their rigour, or the great end of the arrangement is fruſtrated. In fact, natural genera exiſt not, but in a natural method. Every artificial method has its own proper genera, becauſe the principle varies in each. To attempt therefore, to mould the genera of a ſyſtem, profeſſedly artificial, after thoſe of a method not yet detected, and whoſe principles are totally different, is, in effect, not only to confound artificial methods with the natural, but to counteract the very end and intention of arrangement altogether. A genus is a ſubaltern diviſion in every method; it ſubdivides the ſection or order, in like manner as the order ſubdivides the claſs. Certain characters flowing from the genius of the method ſerve to diſcriminate each diviſion: the genus has its peculiar marks of diſtinction, by which, as by fixed laws, it is regulated and reſtrained. Can we then blame an author who, intent upon giving facility to his method, ſhall refuſe to incorporate plants of the ſame ſuppoſed natural claſs and genus, when ſuch junction cannot be effected without fruſtrating the arragement, and deſtroying its eſſence?

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Shall Rivinus be cenſured if, in a method founded upon the regularity and number of the petals, he has choſen to ſeparate regular flowers from the irregular, and plants with one petal from ſuch as have two or more, even although their agreement in the habit, and other characters, ſhould determine ſome of thoſe ſo ſeparated to belong to the ſame natural claſs? Had he acted otherwiſe, he would have confounded his artificial character with the natural, and rendered his method of no avail. I am not to learn, that the excellence of the artificial character conſiſts in its approximation to the natural; and that a method is undoubtedly rendered more valuable by the greater number of natural families which it collects. But ſtill the end of an arrangement is to be kept in view; and if a multitude of natural claſſes cannot be collected by an artificial character, without fruſtrating that end, and rendering the method impracticable, I am clearly of opinion that ſuch natural aſſemblages are to be abandoned without reſerve, and that character adopted which, by its facility, bids faireſt to be moſt extenſively uſeful. Rivinus, however, is not only cenſured for employing a character which admits not of natural claſſes; he has alſo been reprehended for neglecting to retain ſuch claſſes, although this he could not have done without infringing the fundamental laws of his method. Moſt of the liliaceous or bulbous-rooted plants have flowers compoſed of ſix regular petals: in a few, however, particularly hyacinth, crocus and narciſſus, the diviſions of the flower, which are ſix in number and equal, do not reach the bottom, and conſequently form but one piece. I leave it to the reader to judge whether Rivinus has not very properly ſeparated theſe different orders of the liliaceous plants, by arranging the latter with regular flowers of one petal; the former with ſuch as have ſix diſtinct petals. Had he acted otherwiſe, I ſhould have been the firſt to anathematize his method, as deſtitute of its only recommendation, facility. Again,

Rivinus is ſeverely cenſured by Ray for removing viper's bugloſs from the other rough-leaved plants, to which it is naturally allied. But here, as in the former inſtance, our author will be found perfectly in the right. Viper's bugloſs has a very irregular flower of one petal; comfrey, borrage, hound's-tongue and the other rough-leaved plants are furniſhed with regular flowers, which, in ſhape, reſemble either a bell, funnel or ſalver. Would a novice in Botany have reckoned himſelf obliged to Rivinus, if, ſolicitous to preſerve unbroken the natural order, he had arranged viper's bugloſs with its irregular flower among flowers confeſſedly regular? Rivinus was ſenſible of the impropriety of ſuch a meaſure, which he knew could not be adopted but in direct oppoſition to his own principles: he has therefore very wiſely avoided it, and transferred the genus in queſtion to that diviſion of the method containing irregular flowers of one petal, under which it naturally falls. His ſeparation of tormentil from cinquefoil has met with a ſimilar reprehenſion that is equally ill-founded. Tormentil has four equal petals, cinquefoil five. Would not Rivinus have merited cenſure, had he arranged theſe under one claſs? A perſon who turns over a dictionary expects to find the words arranged in an order ſtrictly alphabetical; the leaſt error in orthography, the ſlighteſt deviation from thoſe laws by which the compilation is agreed to be regulated, render the nomenclature, in thoſe particular inſtances, totally uſeleſs. It is juſt ſo with a botanical method. If it is agreed that all plants having the ſame number of regular petals ſhall be arranged under one claſs, in like manner as all words with the ſame initial letter occupy the ſame diviſion of a dictionary; would it not be highly abſurd, in direct oppoſition to ſuch agreement, to place flowers of four petals in the ſame claſs with ſuch as have five, or conjoin plants of one regular petal with ſuch as have ſix? The learner would no more dream of ſuch ridiculous junctions, than

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he who peruſes a dictionary expects to find the word BOTANY under the letter A. Other charges, of a ſimilar nature with thoſe already canvaſſed have been directed againſt our author by Ray, Blair, and the other lovers of affinities: but theſe I forbear mentioning, becauſe the reader muſt be convinced, from the inſtances already quoted, that the improprieties imputed by theſe writers to Rivinus, are, in fact, the beauties and perfection of his method. An author who adopts a principle, is obliged to adhere to it with the moſt ſcrupulous exactneſs. The leaſt deviation is an unpardonable error, becauſe calculated to miſlead. A convention is entered into by the author with the learner, and that convention he muſt religiouſly obſerve. The queſtion is not, whether the principle be more or leſs excellent: it has been adopted, and muſt either be rigidly adhered to, or totally abandoned. If a writer is convinced of the inſufficiency of his principle, let him adopt another, and new-mould his method accordingly: but let him never engraft one principle upon another; let the execution always correſpond to the plan.

I NOW proceed to mention imperfections of a different kind that have been imputed to this method, and which, if indeed they have an exiſtence, are chargeable, not upon the plan, but its execution. Some ſpecies of valerian have regular, ſome irregular flowers. Under what branch of Rivinus's method is the genus to be placed? if totally under the diviſion of regular or irregular flowers, a manifeſt impropriety is committed, becauſe the ſegments of the petal in ſome of the ſpecies are equal, in others, unequal: If partly under both, a violence is done to nature, and plants, to preſerve the credit of an artificial character, are forcibly torn from the ſociety of thoſe to which they are moſt nearly allied. Such is the argument of the opponents of this method, which I truſt to anſwer to the ſatisfaction of the reader. It proceeds

ceeds upon an implied ſuppoſition that genera are as fixed and invariable as ſpecies, than which nothing can be more falſe or hypothetical. In every artificial method the genera are different, becauſe the genus, in ſuch methods, is as arbitrary a diviſion as either the claſs or order. The principle of every artificial method is different; its claſſes are different; the genera therefore, which are only ſubaltern diviſions of the claſſes, muſt be different alſo. Is it not evident, that the ſame principle which new-models the claſs or primary diviſion, muſt operate in faſhioning the genus or ſubordinate one? If the genera were indeed fixed, as is pretended, artificial methods could be of no utility whatever: as all the ſpecies of ſuch genera would very rarely be found to arrange themſelves under their proper claſs and order. Moſt of the intricacies in the ſexual ſyſtem proceed from this ſource, as will afterwards be fully ſhewn. This being premiſed, I am ready to anſwer the queſtion that was propoſed above. To me, indeed, the alternative never appeared difficult, becauſe I am clearly of opinion that the principles of a method are to be obſerved in all their rigour, notwithſtanding any ſeeming inconveniencies with which ſo ſtrict an adherence may be attended. In a method founded upon the equality of the petals, all regular flowers naturally arrange themſelves under one diviſion, all irregular flowers under another. It is in vain that I am told of natural genera being ſplit by ſuch a mode of arrangement; I acknowledge no natural genera in an artificial method: I diſavow every genus that is independent of its claſs and order, and claims to be aſcertained without their aſſiſtance. As a ſubaltern diviſion, not of the claſs only, but alſo of the order, a genus muſt poſſeſs the diſtinguiſhing characters of both. For if the claſſical character is wanting, we miſtake the claſs: if that of the order, we miſtake the order: and it is evident, that if the plant is referred either to a wrong claſs or order, it can never be detected: the genus

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muſt always remain unknown. Perhaps few of the plants which now arrange as ſpecies of valerian were known to Rivinus; if they had, I make no doubt that he would have formed them into ſeveral genera, had the principles of his method required it. I ſhall only add, that if, in arranging the ſpecies which he confeſſedly knew he has, in any reſpect, violated thoſe principles, the fault ought ſolely to be imputed to the author, not to his plan. Again, the European ſpecies of Geranium being furniſhed with a regular flower, the African with an irregular, Rivinus has very properly formed them into two genera, by the names of *Gruinalis*, that is, crane's bill, and *Geranium*, which he has placed, one in the diviſion of regular, the other of irregular flowers. The author cannot be ſo well defended for placing all the umbelliferous plants in a claſs containing irregular flowers; many of them, and thoſe known to Rivinus, particularly lovage, hog's fennel, ſium, parſley, and herb-gerard, have five petals that are perfectly equal. Theſe, undoubtedly, ſhould have been transferred to the diviſion containing regular flowers, becauſe they do not poſſeſs the character of the diviſion in which they are placed. The lip-flowers occupy part of that claſs in Rivinus's method which is deſtined for containing plants with one irregular petal: yet may it be doubted whether mint, iron-wort and water horehound do not more properly fall under the diviſion containing regular flowers; as, in the plants in queſtion, the upper lip is ſcarce to be diſtinguiſhed from the lower, and the flower, at firſt ſight, appears to be divided into four equal parts. There is a manifeſt impropriety too in arranging with the irregular flowers of four petals ſuch pea-bloom flowers as have undoubtedly five. Of this kind are liquorice and broom, in which the keel or innermoſt part of the flower forms two diſtinct petals. Other papilionaceous flowers, not known to Rivinus, are found to conſiſt of five irregular petals. Such are *ſecuridaca*, coral tree, *borbonia*,

borbonia, furze, and *pſoralea*; in the firſt of which the ſtandard, in the reſt the keel, is divided into two parts that are totally diſtinct. Some ſpecies of trefoil have an irregular papilionaceous flower of one petal, the ſtandard, wings and keel being conjoined. It would therefore be highly improper to place theſe in Rivinus's method along with the other trefoils, which are furniſhed with four irregular petals. They ought, in conformity to the principles of the method, to form a ſeparate genus, and be transferred to the claſs containing irregular flowers of one petal. I do not much approve of fumatory and balſam being placed with the papilionaceous flowers. Chriſtian Knaut has judged better in transferring the former to the claſs of irregular flowers with two petals: and as to the latter, it has generally five irregular petals, and therefore ſhould be removed to the claſs which immediately ſucceeds. Some ſpecies of balſam, which want the two intermediate petals, are to be placed without reſerve in the claſs containing irregular flowers with three petals. With reſpect to the genus *ſtatice*, which has been urged againſt our author, becauſe a particular ſpecies, the *ſtatice monopetala* of Linnæus, bears flowers of one petal, whilſt the reſt have five equal petals, it is certain, that no ſpecies of *ſtatice* are mentioned either by Rivinus or Heucher; and, it is highly probable, if they had, that the ſpecies alluded to would have been removed to that diviſion of the method, whoſe claſſical character it poſſeſſes. In arranging the compound flowers, Rivinus has been guilty of a real impropriety. We have ſeen that Moriſon, Ray and Herman did not ſcruple to rank with the compound flowers, ſcabious, teazel, and a few other plants, which, though they do not abſolutely poſſeſs all the diſtinguiſhing characters of that tribe, yet are ſo approximated to it by their general appearance, that no great violence is done either to nature, or the principles of the method by combining them. The ſimple flowers which Rivinus has

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annexed to this tribe have not even the plea of affinity to offer. In fact, who would think of placing water-lilly, fennel-flower, and hellebore in the ſame claſs with the compound flowers? They poſſeſs no natural relations; nor do I believe that there exiſts an artificial character which could approximate them. Rivinus's principle of combination is no leſs ſtrange than the combination itſelf. Compound flowers, properly ſo called, he conſiders with Jungius as flowers that are naturally full; the ſimple flowers juſt mentioned, as flowers naturally double, and conſequently connected with the former, in the ſame manner as flowers that are rendered double by luxuriance of nouriſhment have a manifeſt affinity to ſuch as, from the different agency of the ſame cauſe, are rendered full. Our author's application of this very extraordinary principle will be beſt underſtood by an example. Yellow water-lilly has a flower-cup of five diſtinct pieces, within which are placed a number of petals in more than a ſingle row or ſeries. The flower-cup Rivinus reckons the outermoſt row of petals; and although its five leaves are diſſimilar to the internal petals, yet is each cover regular, conſidered in itſelf, becauſe its parts are ſimilar and equal. For theſe reaſons Rivinus has arranged the water-lilly with thoſe compound flowers, all whoſe florets are regular. It is deſcribed to have a regular flower of five petals in the circumference or ray, and one of many petals, likewiſe regular, in the center or diſk. Again, fennel-flower has five flat regular petals, within which are placed eight ſingular appearances, termed by Linnæus, *Nectaria*, each furniſhed with two lips. Rivinus arranges this plant with the radiated flowers of Tournefort, and aſſigns for his reaſon, that it is compoſed of a regular flower of five petals in the circumference, and of ſeveral irregular flowers of one petal in the center: the former correſponding to the real petals of the flower, the latter to the *nectaria*.

In the uniformity of its orders or ſecondary diviſions, which are ninety-one in number, and acknowledge the fruit for their principle, the method before us equals, perhaps excells, all that went before or ſucceeded it. Only three claſſes of his method were publiſhed by Rivinus himſelf. Theſe are the eleventh, fourteenth and fifteenth, which contain irregular flowers of one, four and five petals, and were given to the world at different times, illuſtrated with very ſplendid figures. The method was compleated and publiſhed entire by Heucher in a work entitled *Hortus Wittenbergenſis*, printed in quarto at Wittenberg in 1711.

Several German authors have followed Rivinus's method, either wholly or in part, without offering any conſiderable amendment. The principal of theſe are, Koenig, in a work on vegetables, publiſhed at Baſil in 1696; Welſch, in his *Baſis Botanica*, printed at Leipſic in octavo, in 1697; Gemeinhart, in a catalogue of plants publiſhed in 1725; Kramer, in a work entitled *Tentamen Botanicum*, publiſhed at Dreſden in 1728, and afterwards reprinted with additions at Vienna in 1744; and Hecker, in a diſſertation on Botany publiſhed at Hal in Saxony in 1734. To theſe may be added Hebenſtreit, an ingenious botaniſt, who, in a treatiſe on plants, publiſhed at Leipſic in 1731, juſt before his famous African expedition, eſtabliſhed generical characters, which had hitherto been wanting in Rivinus's method.

The writers who have affected to improve upon the method under review are Bernard Ruppius, Chriſtopher Ludwig and Chriſtian Knaut, likewiſe Germans. Of theſe in order.

Ruppius, in his *Flora Jenenſis*, publiſhed at Frankfort in 1718, has arranged the twelve hundred plants there deſcribed by a method,

a method, partly Rivinus's, and partly his own. It conſiſts of ſeventeen claſſes, and ſets out with the ſame diviſions and ſubdiviſions as that of his author, with this difference, however, that, whereas in Rivinus, all perfect flowers are divided into ſimple and compound; in Ruppius, the diviſion of regular and irregular flowers precedes that juſt mentioned, and ſimple and compound flowers are made ſubdiviſions of the regular flowers only. If Ruppius meant this as an improvement, he has certainly miſtaken his aim. By reſtricting the compound flowers to that diviſion of the method which includes regular flowers and none other, he has, in fact, aſſerted that all compound flowers are regular; an aſſertion in which he ſtands contradicted by the mereſt beginner; nay, even by himſelf: for, in the diſtribution of that tribe of plants, Ruppius's orders exactly correſpond to Rivinus's claſſes, and conſiſt of ſuch compound flowers whoſe florets are either all regular, all irregular, or compoſed of both. The fact is, that Rivinus led his imitator into the error complained of, by improperly interjecting the compound flowers betwixt the regular and irregular ſimple flowers. In Rivinus's method, the imperfect flowers are contained in one claſs; in that of Ruppius, they are parcelled out into three, one of which contains the graſſes, another, the cone-bearing plants, ſuch whoſe flowers grow in catkins, and a few others; and a third, the ferns, moſſes and muſhrooms, which want the flower altogether. Theſe claſſes, the reader will remember, correſpond to moſt of the ſections in Rivinus's ſingle claſs. Ruppius has judged wrong in excluding from his method the claſs containing irregular flowers with many petals; becauſe, although no plants were known to that author, no more than to Rivinus, that could arrange themſelves under ſuch claſs, yet plants of that deſcription might be afterwards diſcovered, and a method, to be univerſal, ought to accommodate itſelf no leſs to future diſcoveries than to thoſe

already made. In ſhort, the only real improvement which Ruppius has made upon Rivinus's method is in diſincumbering the compound flowers of ſcabious, teazel, eryngo, paſſion-flower, hellebore, fennel-flower, water-lilly and pine-apple, which Rivinus had very improperly thruſt into that tribe.

CHRISTOPHER Ludwig's method, which was publiſhed in 1737, and conſiſts of twenty claſſes, differs but little from that of Rivinus. The author accompanied Hebenſtreit on his expedition into Africa, and ſeems to have made plants his favourite ſtudy. I cannot, however, congratulate the learned reader on the improvements which Ludwig has pretended to make on Rivinus's plan. To me they appear not only uſeleſs but detrimental. Part of Rivinus's claſs, containing the imperfect flowers, is transferred to the diviſion of perfect or compleat flowers, and for that purpoſe theſe laſt are ſubdivided, from the preſence or abſence of the petals: the plants ſo transferred being deſcribed to be ſuch as want the petals, but are furniſhed with the flower-cup. This, as the reader will remember, is Ray's diſtinction revived, the inconveniencies of which need not be here repeated. Ludwig follows Ruppius in reſtricting the compound flowers to that diviſion of the method which contains plants with regular flowers, and in excluding Rivinus's claſs of irregular flowers with many petals. Like Ruppius, too, he diſtributes the imperfect flowers among three claſſes, which, however, do not exactly correſpond in both methods. The palms, graſſes and ſome other plants occupy the firſt; the cone-bearing plants, and thoſe whoſe flowers grow in catkins, the ſecond; the ferns, moſſes, muſhrooms, and ſubmarine plants, the third. In fine, Ludwig's method is only that of Rivinus rendered more univerſal; the author having enriched it with a multitude of genera, collected from the works of Tournefort, Ray, Boerhaave, Dillenius, and other eminent

eminent botaniſts, whoſe generical characters he has likewiſe adopted. His plan of arrangement has been followed by two ſucceeding writers: M. Wedel, in a botanical Eſſay, publiſhed in 1747; and three years after by M. Boehmer, in his Catalogue of the Plants which grow in the neighbourhood of Leipſic.

CHRISTIAN Knaut, although prior to both the writers juſt named, I have choſen to mention laſt, becauſe the plan of arrangement which he propoſed, is more properly his own, and departs in a much greater degree from the principles of Rivinus than that of either Ruppius or Ludwig. The regularity and number of the petals furniſhed, as we have ſeen, the claſſical diſtinctions in Rivinus's method; in that of Knaut, number takes place of regularity; ſo that it is very properly termed by Linnæus, the ſyſtem of Rivinus inverted. The method in queſtion, which conſiſts of ſeventeen claſſes, and was publiſhed at Leipſic in 1716, ſets out with a diviſion into flowers which have one petal, and ſuch as have more than one. Flowers with one petal occupy the firſt five claſſes, and are ſubdivided into ſimple and aggregate. Theſe laſt, the compound flowers of Rivinus, conſtitute the third, fourth and fifth claſſes, which ſtand diſtinguiſhed as in the original author. Simple flowers with one petal arrange themſelves in the firſt and ſecond claſſes, and are ſubdivided from the equality and inequality of the flower. The ſame character predominates in the ſeveral ſubdiviſions of the ſecond great branch of the method, that, to wit, containing flowers with more than one petal. Theſe ſubdiviſions are ſix in number, and conſiſt each of two claſſes, which, like the ſimple flowers with one petal, ſtand diſtinguiſhed by the regularity or irregularity of the flowers. The firſt phalanx of the grand diviſion alluded to contains flowers with two petals, and thoſe either

either regular or irregular; the ſecond, three; the third, four; the fourth, five; the fifth, ſix; the ſixth, many, or an indefinite number.

Such is the ſkeleton of Chriſtian Knaut's method, which, as the reader will obſerve, is incompleat, becauſe the plants with imperfect flowers, which form the eighteenth claſs of Rivinus, find no place in the ſyſtem of our author. It was Knaut's intention to remove this defect in a future edition of his work; but as far as I can learn, he never compleated his purpoſe. The ſections or ſecondary diviſions are an hundred and twenty-one in number, and depend upon the internal diviſions of the fruit. Upon this ſubject, the opinions of Knaut are ſomewhat ſingular. Every kind of fruit, whether pulpy or membranaceous, is denominated by our author a Capſule. Neither is this term reſtricted to fruits properly ſo called: it is extended alſo to thoſe termed by botaniſts, *naked ſeeds*, the exiſtence of which Knaut abſolutely denies. I formerly demonſtrated that this opinion proceeds upon miſtaken notions of the analogy ſubſiſting between plants and animals. Difficult as it certainly is to eſtabliſh a criterion which, in every caſe, ſhall, with accuracy, diſcriminate naked from covered ſeeds; it were highly abſurd to diſpute the reality of the diſtinction. I appeal to the reader whether he entertains any doubt that the umbelliferous plants, the compound and lip-flowers are furniſhed with true naked ſeeds; or, if he had rather adhere to Chriſtian Knaut's opinion, and denominate the fruits in queſtion, capſules with an undivided cavity, and a ſingle ſeed. Since I am upon this ſubject, it will not be improper to explain a few terms which occur in our author's method, and which, if underſtood, will greatly facilitate the knowledge of his ſecondary characters. It has been already mentioned, that every kind of fruit, whether properly or improperly ſo called, is termed by

Knaut

Knaut capſular. Capſules, with reſpect to their conſiſtence or ſubſtance, are of two ſorts, pulpy or ſucculent and membranaceous. The former correſpond to the fruits of the apple, berry and cherry kind; the latter to the capſules properly ſo called, and naked ſeeds of other botaniſts. Again, with reſpect to their cells or internal diviſions, Capſules are either ſimple or compound. Simple Capſules have an undivided cavity or a ſingle cell; compound capſules are internally divided into two or more cells. With other botaniſts, the umbelliferous plants bear two, the lip flowers four, naked ſeeds; according to Knaut, the former produce two ſimple capſules, the latter, four. Ranunculus, adonis, anemony, herb-bennet, and ſome other plants have their flowers ſucceeded by a number of naked ſeeds collected into an aggregate or head. Each of theſe ſeeds paſſes with Knaut for a ſimple Capſule; ſo that the whole is an aggregate of ſeveral capſules with an undivided cavity or ſingle cell. In numbering the cells or internal diviſions of the pulpy fruits, our author has adopted a very ſingular mode of calculation. Some fruits of the apple kind incloſe a capſule that is divided into five membranaceous cells. Might we not then very reaſonably expect to find ſuch fruits arranged with compound capſules of five cells? In vain, however, would be our moſt unwearied ſearch in that quarter. The author whimſically enough combines in their arrangement the idea both of a ſimple and compound capſule. The pulpy part is undivided, in other words, it is a ſimple capſule furniſhed with one cell; the compound capſule incloſed contains five cells, which added to that of the pulp make the number ſix; and with compound capſules of ſix cells are the fruits in queſtion made to arrange. It is by the ſame paradoxical reaſoning, that the fruit of dogwood which is of the cherry kind, and contains a ſtone with two cells or cavities, is placed by Knaut among compound capſules with three

three cells; the pulp paſſing for one diviſion, the cavities of the ſtone or nut for the remaining two.

SINGULAR as is this mode of calculation, it is not the only paradox which our author has been accuſed of maintaining. The eſſence of the flower is made by Ray, Tournefort, Rivinus and moſt botaniſts to conſiſt in the ſtamina and ſtyle. This poſition Knaut abſolutely denies, and has eſtabliſhed for a principle, that the flower is eſſentially conſtituted by the petals only. The flower-cup, ſtamina and ſtyle are of little ſignificance with Knaut; their preſence does not conſtitute a flower, if the petals are wanting; neither is their abſence ſufficient to deſtroy its exiſtence, if the petals are preſent. From this propoſition two corollaries are evidently deducible. The one, that a flower without petals is a ſoleciſm in Botany; the other, that the regularity and irregularity of the flower can never depend on the ſtamina and ſtyle, which are only occaſionally preſent, and in no wiſe eſſential to its exiſtence. It were unneceſſary to obſerve on theſe doctrines; their fallacy muſt be obvious to every reader.

I CLOSE my review of Knaut's tenets and method of arrangement with the examination of an heretical aphoriſm laid down by that author reſpecting his diſtribution of the genera. To be qualified for pronouncing of its merits, we muſt have accurate and preciſe ideas upon the ſubject; and theſe can in no way ſo certainly be obtained, as by an enquiry into the nature of that particular member of a method denominated a genus. In every artificial plan of arangement, the claſſical character is arbitrary, and depends upon a ſingle circumſtance. The orders or ſecondary diviſions are ſubdiviſions of the claſs; each order therefore, beſides its own proper character, poſſeſſes the common character of the claſs, of which it is a ſubdiviſion. As orders ſubdivide the

the claſs, genera ſubdivide the order: each genus, therefore, whilſt it poſſeſſes the common characters of the claſs and order, muſt ſtand diſtinguiſhed from all of the ſame order, by means of ſome character that is proper and peculiar to itſelf. The ſubdiviſions of a genus are termed ſpecies, each of which muſt conſequently agree in the common characters of the claſs, order and genus, and be diſtinguiſhed from its congeners by the poſſeſſion of a character that is properly its own. Such is the real ſtate of the ſubordination that ought to be obſerved betwixt the ſeveral parts or members of an artificial method. As ſtriking characters, however, cannot be found for diſcriminating every genus, it has been thought neceſſary, in default of ſuch eſſential marks, to call in the aſſiſtance of various parts of the plant, that the characters thence derived might attone, by their number, for the want of notoriety. The parts of fructification ſeemed, of all others, the moſt proper for this purpoſe. Theſe had, ever ſince the time of Geſner, furniſhed the ſole claſſical diſtinctions; and it was that author who firſt ſuggeſted their utility in diſcriminating the genera. In every orthodox method, the common generical characters muſt be founded on the parts of fructification, becauſe the genera are only ſubdiviſions of the claſs and order which acknowledge thoſe parts for their principle of diſtribution. For this reaſon, it appeared to Geſner highly proper that the diſcriminating character of genera, no leſs than that of claſſes and orders, ſhould be derived from the parts of the flower and fruit. It is in very few caſes, however, that a ſingle diſtinctive generical character will ſuffice. What then is the moſt eligible way of diſcriminating the genera, where conſpicuous and eſſential characters are wanting? To call in the aid of a multiplicity of characters, and ſubſtitute many in the place of one. It has furniſhed matter of controverſy to botaniſts, whether ſuch

characters ſhould be ſolely derived from the parts of fructification, from a combination of theſe and the other parts of the plant, or occaſionally only from the latter. Tournefort, the firſt who realized Geſner's idea reſpecting the diſtribution of the genera, never fails to have recourſe to the other parts when thoſe of the flower and fruit prove inſufficient. But it is only in caſes where their aſſiſtance cannot be diſpenſed with, that Tournefort has thought proper to employ the parts in queſtion. His primary genera, or genera of the firſt order, agree only in the parts of fructification; his ſubaltern genera, or thoſe of the ſecond order, call in the other parts of the plant as auxiliaries. Linnæus has adopted the principle of Geſner in all its rigour; and lays it down as an aphoriſm in no caſe to be departed from, that generical characters are to be derived from all the parts of fructification, and from none other. The habit or general appearance of plants, the various modes of flowering, the ſtructure of the root, ſtem and other parts unconnected with fructification, are employed in furniſhing generical diſtinctions by a third ſet of writers, in combination with the parts of the flower and fruit. With botaniſts of this claſs, Chriſtian Knaut is properly to be ranked, although the aphoriſm to be examined is, perhaps, peculiar to himſelf. The deſcription of a genus, according to Linnæus, is an enumeration of all the parts and modifications of the flower and fruit of the plants which compoſe it. Theſe parts too, ought, in ſtrict propriety, to be exactly the ſame in all the different ſpecies: as a genus is conſtituted by the agreements of a number of ſpecies in the parts of fructification. But two ſpecies are very rarely to be found that agree in all the organs of the flower and fruit, and their ſeveral modifications. It is with ſome latitude, therefore, that we are to underſtand the term genus; for if, to conſtitute ſuch an aſſemblage, it were neceſſary that the parts of the flower and fruit of the ſeveral ſpecies be in every

reſpect

reſpect ſimilar, the very end of the diviſion is fruſtrated, and genera are reſolved into mere ſpecies. This poſition, however, abſurd as it muſt appear, has had its abettors, and is, in fact, the very aphoriſm which I have been preparing the reader to confute. It is a maxim with Knaut, that the minuteſt difference in any of the parts of fructification in two different ſpecies is ſufficient to juſtify a ſeparation of ſuch ſpecies under different genera; nay, that it is abſolutely unſyſtematical to place plants with four petals in the ſame genus with ſuch as have five, or fruits of three cells with ſuch as have four. It has juſt been hinted, that a rigorous obſervance of this rule would occaſion an unneceſſary multiplication of genera, or rather indeed annihilate genera altogether, by confounding them with ſpecies, which are properly their component or conſtituent parts. But with whatever zeal I am inclined to oppoſe a dogma ſo big with abſurdity, and which, if ſtrictly followed, muſt ſap the very foundations of the ſcience, I would by no means wiſh to have it inculcated that, in the diſtribution of genera, too great latitude cannot be uſed. The enormous weight of genera is, in fact, no leſs prejudicial to Botany on the one hand, than the unneceſſary multiplication of their number is on the other. To avoid either extreme ought to be the care of every ſyſtematic writer, who cannot be too often reminded that the ſcience is in equal danger from both. Let it be remembered likewiſe that genera, to be perfect, muſt accommodate themſelves to the principles of the method under which they arrange. This rule muſt be inviolably obſerved; it admits of no exception whatever; the ſlighteſt deviation is attended with unavoidable confuſion. If genera through all their ſpecies do not invariably poſſeſs the common characters of the claſs and order of which they are ſubdiviſions, by what rule ſhall they be inveſtigated? In a method founded upon the number of petals, we ſhould never dream of looking for

genera with flowers of five petals in the ſame claſs with ſuch as have ſix; neither, for the ſame reaſon, ſhould we expect to find a different number of petals in the different ſpecies of the ſame genus. Again, if the orders or ſecondary diviſions derive their characteriſtical diſtinctions from the parts of the fruit, it is obvious, that the fruit of all the ſpecies of each genus muſt agree in that particular mark which characteriſes the order. Fruits of four cells are very improperly placed in the ſame order with ſuch as have five; and that whether the whole genus, or a particular ſpecies only, is deficient in the character of its reſpective order. If the former, the genus muſt be totally transferred to an order whoſe character it poſſeſſes; if the latter, it is reſolved into two diſtinct genera which arrange themſelves under ſeparate orders. Upon the whole, though I entirely diſapprove of Knaut's maxim, and can diſcern every bad conſequence with which its moſt rigorous obſervance would be attended, I cannot help thinking it entitled to ſome ſhare of indulgence, when it is conſidered that the author has been moſt probably betrayed into this error by a laudable deſire of accommodating the genera to the principles of his method. This opinion I am the rather inclined to adopt, as, in propoſing the aphoriſm in queſtion, our author has particularized the circumſtance of number, which furniſhes both his claſſical and ſecondary characters; the former being derived from the number of petals, the latter from the number of cells or internal diviſions of the fruit.

We are now arrived at the moſt important æra in the hiſtory of Botany. Here therefore the reader will not be diſpleaſed to ſtop with me for a moment, whilſt I briefly recapitulate the ſubject of the foregoing ſheets. It was the profeſſed intention of this prefatory View to trace Botanical knowledge through the various ſtages of its progreſs, to diſtinguiſh artificial methods from

from the natural, and point out the reſpective excellencies of each, to eſtabliſh orthodox doctrines reſpecting the diſtribution of the genera, to illuſtrate, analyſe and compare the various plans that have been imagined for arranging vegetables; in fine, to render Botany a ſcience of eaſy attainment, by removing the obſtacles that have retarded its progreſs. In the proſecution of this plan, I have hitherto endeavoured to expreſs myſelf with as much preciſion and perſpicuity as the nature of the ſcience and our language would admit. The artificial methods that have been analyſed are thoſe of Cæſalpinus, Moriſon, Ray, Chriſtopher Knaut, Herman, Boerhaave, Rivinus, Ruppius, Ludwig and Chriſtian Knaut: the four laſt from the number of petals, the reſt from the ſubſtance, number and figure of the fruit. Partial attachments to particular ſyſtems are totally unbecoming the gravity of a philoſophical diſcuſſion; I have therefore carefully avoided laviſhing praiſe where I could not impreſs conviction of its being properly beſtowed. It is for the ſame reaſon that, whilſt I have ſtudied to do juſtice to the merits of each ſyſtematic writer, who has hitherto paſſed under review, I have held forth none as infallible or void of imperfection. The man who, in matters of ſcience, wilfully conceals the errors of another adopts them as his own. Upon this principle, I have ventured in a few controverted points to differ from ſome diſtinguiſhed names in Botany. For the fate of ſuch criticiſms, however, I am in no wiſe ſolicitous. By the blindly partial they will perhaps be condemned without a hearing; by the man of candour and ingenuity they can ſcarce fail of being treated with reſpect, in honour of the principle which gave them exiſtence. I, for my own part, glory in aſſerting the right of free enquiry; I diſclaim a ſlaviſh attachment to any ſect or ſyſtem, however eminent; I acknowledge no pope in ſcience: the human mind is free and unconſtrained; it is fit that the ſpirit of enquiry ſhould be free alſo.

I CON-

I CONCLUDE the preſent ſection with obſerving that ſince the time of Rivinus, only two leading methods have been offered to the world. Theſe are Tournefort's from the figure of the petals, and the celebrated ſexual ſyſtem of Linnæus from the number, ſituation, union and proportion of the ſtamina. A particular illuſtration of each of theſe methods, with a view of their comparative merits, will make the ſubject of the two following ſections.

SECTION

INSTITUTES

OF

BOTANY.

PART THE SECOND:

CONTAINING

An Analyſis and Examination of the TOURNEFORTIAN and LINNÆAN Methods of Arrangement;

AS LIKEWISE

The Eſſential and Secondary Characters of all the Genera which compoſe the Three firſt Claſſes of the Latter.

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Reader on Botany in London, Author of the BOTANICAL DICTIONARY.

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MDCCLXXII.

INSTITUTES

OF

BOTANY.

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Printed for W. Griffin, Bookseller, Castle-street, J. North, Bookseller to His Majesty, R. Baldwin, opposite Southampton-street, Strand; E. White, Fleet-street, Mills, Fletcher and Urquhart, under the Royal Exchange; Hookham and Carpenter's Head, in the Strand; and J. Robson,

MDCCLXXII.

SECTION V.

Sequel of the Hiſtory of Botany from the time of Rivinus to the introduction of the Sexual Syſtem.

IN the diſtribution of the various plans of arrangement under general heads, the reader may remember a diviſion of Botanical Methods into Univerſal and Partial. The former include all known plants; the latter are limited to thoſe of a particular tribe. Of Univerſal Methods, ſome acknowledge the fruit, ſome the flower for their baſis. Methods founded upon the fruit are leſs numerous than thoſe derived from the flower, becauſe the parts, and modifications of parts, of the latter, are ſuperior in number, and can be diverſified in a greater variety of ſhapes. The ſubſtance or conſiſtence of the ſeed-veſſel, and number of the ſeeds, furniſh almoſt the ſole diſtinctions in the firſt claſs of Univerſal Methods juſt mentioned; whilſt, in the ſecond, the parts being numerous, give riſe to manifold diſtinctions, which extend themſelves into a variety of methods, each independent, and unconnected with every other. Theſe diſtinctions chiefly reſpect the number, regularity and figure of the petals or flower-leaves; the figure, ſituation, duration, and regularity of the flower-cup; the number, proportion, union, ſituation and abſence of the ſtamina, threads or pretended male organ.

THIS brief Analyſis the reader, it is preſumed, will not judge unneceſſary, as it both eſtabliſhes a connection betwixt the

ſeveral ſubjects of this Hiſtorical VIEW, and ſerves to aſcertain the preciſe place in the general ſcheme to which each individual method is to be referred. The principal methods that compoſe the firſt claſs are thoſe of Cæſalpinus, Moriſon, Ray, Herman and Chriſtopher Knaut. Theſe, after a minute and impartial examination, were diſmiſſed with this general cenſure, that they conduct, with the utmoſt difficulty, to the knowledge of plants; that they are totally devoid of uniformity; and that, in purſuit of natural affinities, of which their authors were remarkably fond, they have entirely overlooked that preciſion and facility, which conſtitute the principal excellence, and are indeed the moſt uſeful properties of every nomenclature. The ſecond claſs or grand diviſion of Univerſal Methods forms, in ſubdividing itſelf, three principal branches, ſome of which ſubdivide themſelves in their turn. Of the three branches or ſubdiviſions alluded to, each reſpects an important part of the flower: one, the petals or flower-leaves; another the calix or cup; a third the ſtamina or threads, which ſtand within both the other parts. The petals, which are the moſt beautiful and ſtriking part of the flower, and the immediate object of the firſt branch, may be viewed in reſpect to either number or figure. Hence a two-fold diviſion of the branch in queſtion. The methods, whoſe leading character is the number of petals, are thoſe of Rivinus, and his profeſſed imitators, Ruppius, Ludwig, and Chriſtian Knaut. Tournefort, and after him Pontedera, the one a Frenchman, the other a native of Italy, have each adopted the diſtinction from the figure of the petals, which they conſidered as a more certain and infallible mark of diſcrimination, than that derived from their number. In analyſing the firſt ſeries of arrangements, I have been led to make ſome general reflections upon the conveniencies and ſuperior

advantages of methods founded upon the flower, and to do juſtice to the merits of Rivinus, who, although the firſt that availed himſelf of thoſe advantages to promote the purpoſes of ſcience, has received, neither from contemporary writers, nor from poſterity, that tribute of acknowledgement which was ſo eminently his due.

METHODS founded upon the figure of the petals come next, in the order of the general ſcheme, to be examined. In ſetting out, a queſtion occurs. Is figure in general, or that of the petals in particular, a more infallible mark of diſtinction than number? If not, upon what grounds is Tournefort's method ſo univerſally preferred to that of Rivinus; ſince every arrangement neceſſarily involves in it the errors and defects of its principle or leading character? In anſwer to theſe queſtions, which are of conſequence in aſcertaining the comparative merits of the rival-methods under review, let it, firſt of all, be obſerved, that were each diſtinction equally fixed and invariable, each were not therefore equally proper for the purpoſe of ſcientific arrangement. The aſſertion ſeems ſtrange and unaccountable, but is, nevertheleſs, abſolutely and ſtrictly true. Not that the conſtancy of the leading character, which we have ſuppoſed equal in both, can operate differently, and even oppoſitely, by making that fit and proper in the one caſe, which is judged unfit and improper in the other. Such an abſurdity were too glaring to be maintained. But in eſtimating the fitneſs of either diſtinction for the purpoſe alluded to, we are not to confine ourſelves merely to their ſuppoſed conſtancy. Another circumſtance claims our attention. The terms for expreſſing the ſeveral parts and modifications of number are fixed and definite; thoſe which reſpect figure muſt, from the very nature

of things, be highly arbitrary and indefinite. Numerals have a certain determinate meaning affixed to them, which is always the ſame, and can never be ſo affected by circumſtances as to create ambiguity or doubt. Terms of figure, on the other hand, are, in the ſcience of Botany, extremely equivocal; becauſe, deriving their origin chiefly from fancied reſemblances, they will convey different meanings of the ſame ſubject, as often as the author and his readers do not exactly coincide in their ideas of ſimilitude. When Rivinus informs us that enchanters night-ſhade has two regular petals, ladies ſmock four, St. John's wort five, tulip ſix, and anemony many, every one who knows the part in queſtion, and has learned to diſtinguiſh, in dubious caſes, betwixt flowers of one petal, and flowers of more petals than one, muſt enter immediately into the author's meaning, and be thence enabled to refer each plant to its reſpective claſs or diviſion. Let us make a ſimilar experiment in the caſe of figure, and attend the iſſue. That bindweed, bell-flower, deadly night-ſhade, and the numerous plants of the mallow and cucumber tribes, ſhould be made to arrange themſelves under a claſs containing bell-ſhaped flowers, can appear ſtrange to no one who knows ever ſo little of the plants that have been mentioned. The reſemblance is obvious and ſtriking; and it is next to impoſſible that a learner, who has been previouſly inſtructed in the principles and analyſis of Tournefort's method, ſhould miſtake in making the proper reference to his arrangement. A particular claſs, he is informed, the author has allotted for the reception of plants with bell-ſhaped flowers: gentian, melon, and the plants juſt enumerated, have manifeſtly flowers of that deſcription; their place, therefore, in the arrangement, cannot be matter of diſquiſition or doubt for a moment; it is immediately aſcertained. But there are inſtances in which the

determination

determination of the claſs or primary diviſion is not a point of ſuch extreme facility. Who, for example, would look for croſs-wort, ladies bed ſtraw, cleavers, madder and rhubarb among the bell-ſhaped flowers? or expect to find looſe-ſtrife, pimpernel, ſpeedwell, and borrage conjoined with flowers which in ſhape reſemble a funnel? Yet theſe falſe arrangements, incredible as it may appear, are chargeable upon the method adopted by Tournefort; as are likewiſe many others of the ſame kind, which fall more properly to be enumerated hereafter.

THE advocates for FIGURE will not fail to urge that to the titles of his claſſes the French Botaniſt has generally ſubjoined a ſhort definition, explanatory of the title, and deſcriptive of all the plants that are made to arrange themſelves under it. I ſhall too, probably, be reminded of the uncertainty, in many caſes, of accurately diſtinguiſhing the diviſions of flowers with one petal, from the diſtinct and ſeparate leaves of ſuch flowers as have more petals than one; nay, it is well if I am not told that the alledged ſuperiority of number, and conſequent inferiority of figure, is a mere deception: the former, from circumſtances of doubt which frequently occur, being found, notwithſtanding the determinate meaning of the numerals, a no leſs fallible mark of diſtinction in Botanical reſearches than the fancied and vague reſemblances of the latter. Such are the chief objections which lie againſt Rivinus's principle, and may be urged in favour of that of Tournefort. I ſhall anſwer them briefly, and in order. With reſpect to the firſt, it can ſcarce be conceived, that any definition ſhould be explanatory of a title or term, when it is deſcriptive of ſubjects that would not naturally fall under that title. On the other hand, ſuch certain criteria have been eſtabliſhed for diſcriminating, in dubious caſes,

betwixt

betwixt flowers of one petal, and thoſe of more petals than one, that the reader, who has carefully peruſed and duly conſidered the rules laid down on that ſubject in the foregoing ſection, can have few difficulties remaining, nor conſequently doubt of the ſuperior efficacy of number for the purpoſe intended.

HITHERTO we have ſuppoſed the conſtancy of the rival-principles, Number, and Figure, to be equal; and, on that ſuppoſition, have ſeen a manifeſt advantage on the ſide of Number. To be enabled to decide ultimately on the reſpective merits of either principle, we muſt leave no room for ſuppoſition, but determine, with accuracy, in favour of which diſtinction ſo capital a circumſtance as that juſt mentioned declares itſelf.

NUMBER, in the ſcience under review, is ſaid to be inconſtant when the natural number of any of the parts of plants is occaſionally increaſed or diminiſhed. Of either mode of inconſtancy, I ſhall produce examples; and thoſe in greater abundance, out of reſpect to the almoſt univerſal opinion, that Number, in Botany, is ſubject to much greater variations than Figure.

THE head of flowers of a ſpecies of cornelian cherry, the *meſomora* of Rivinus, frequently produces from its centre another head or umbel.

A SIMILAR appearance is often obſerved in the umbels of wild carrot, and milk-parſley; eſpecially where the plants in queſtion have been browſed upon by animals, or, through accident, trampled under foot.

FROM

FROM the centre of one common calix in daiſy, marigold, a ſpecies of hawkweed and ſcabious, are occaſionally produced a number of flowers that ſtand upon long footſtalks. In common camomile, a prolification of the like kind is ſaid to be effected by the puncture of an inſect.

IN ſome ſpecies of looſe-ſtrife and pimpernel, the leaves, which generally grow in pairs, are not ſeldom produced by threes, fours, and fives round the ſtem.

A SPECIES of purple looſe-ſtrife, the *lythrum* of Linnæus, in which likewiſe the leaves generally ſtand oppoſite in pairs, produces them occaſionally by threes.

FINGER-SHAPED leaves accidentally gain an addition of one or two leaves in the ſame ſpecies. A kind of white trefoil mentioned by Caſpar Bauhin, has its leaves frequently compoſed of four, inſtead of three, lobes or leſſer leaves.

To the head of inconſtancy of number may be referred the frequent luxuriancies in the petals or flower-leaves of plants, which are of various kinds. Double, or, as they are ſometimes called, Multiplied Flowers, are ſuch as by an unnatural expanſion of ſome of their parts, acquire a greater number of petals, than flowers of the ſame ſpecies in a natural ſtate. This mode of luxuriance admits of as great a variety of degrees as there are different repetitions of the rows or ſeries of petals. It excludes only a part of the ſtamina, and is found either in flowers of one petal, as campanula and thorn-apple; or in thoſe of more petals than one, as anemony, and hepatica. Full flowers differ from ſuch as are double in having the petals ſo

multiplied

multiplied as to exclude all the ſtamina. Examples of this higheſt degree of luxuriance are afforded in greater number by flowers that have more petals than one. Such are ranunculus, roſe, anemony, columbine, fennel-flower, poppy, pæony, tulip, narciſſus, and marſh-marigold. That thoſe which have only one petal, though more rarely ſubject to plenitude, are not however totally exempted from it, appears from frequent and familiar inſtances of ſuch luxuriance in polianthes, thorn-apple, and hyacinth. All flowers perfectly full, are likewiſe compleatly barren; the eſſential organs of generation being either wholly excluded, or ſo effectually choaked up by the great multiplication of petals, as to render fecundation impoſſible. In this reſpect, alſo, full flowers ſtand diſtinguiſhed from thoſe of an inferior degree of luxuriance, which, neither excluding the ſtamina, nor choaking up the piſtil, always ripen many, and frequently all their ſeeds.

THE ſcales which ſurround the calix of common carnation are frequently multiplied in ſuch abundance as to conſtitute a ſingular ſort of ſpike, reſembling an ear of corn.

SOME flowers which, in their natural ſtate of conformation, have only one petal, become, by accident, furniſhed with many. This is what happens in thoſe flowers of the holly, whoſe ſtamina prove abortive.

AN accidental variation, the reverſe of that juſt mentioned, is obſerved in a ſpecies of lopewort, whoſe petals, naturally five in number, are frequently incorporated into one.

IN kidney bean, as likewiſe in plumb, apricot and cherry-trees, are often to be found two ſeed-veſſels or fruits cloſely

united, and as it were, grafted together, within the ſame calix. The fruits of the latter, too, are frequently ſingular in this reſpect; for whilſt externally they are round, and exhibit no monſtrous appearance, they diſcloſe internally two ſtones or nuts conjoined, which have either an undivided cavity with two ſeeds, or two cells, each containing a ſingle ſeed. Cucumbers, melons, apples, and ſeveral other fruits which are ſurmounted by the flower, form a ſimilar union without the calix, whilſt they are yet tender and herbaceous.

SEVERAL plants, natives of warm and even of temperate climates, are ſubject to loſe their petals, upon being removed into a leſs indulgent atmoſphere, notwithſtanding they continue to produce both flowers and ſeeds. Linnæus has obſerved this ſingular variety in a great number of plants cultivated in Sweden, particularly in a Virginian ſpecies of campanula, and the *ruellia* of Barbadoes.

THE number of ſtamina is occaſionally found to vary in plants of the ſame ſpecies, and even in the ſame individual plant. Nay, there are inſtances of flowers which, in cold climates, drop all or part of their ſtamina, in like manner, and for the ſame reaſons, as the flowers juſt mentioned are found to drop their petals. The *pharnaceum* of Senegal, when removed into Europe, commonly drops two of its ſtamina, producing three only, inſtead of five, which is its natural number.

DOUBLE flowers, as we have ſeen, loſe a part of the ſtamina: full flowers exclude the whole.

SUCH are the principal variations to which number, in the ſcience of Botany, is liable. Before I proceed to enumerate

parallel inſtances of inconſtancy in figure, I would beg leave to remark, that, in ſome of the examples which have been mentioned of occaſional variations in point of number, changes, little leſs remarkable or conſpicuous, are effected in the general ſymmetry and figure of the parts. This obſervation ſeems abundantly verified by the different appearances of ſome campanulas and other flowers of one petal in a natural, and in a luxuriant, ſtate: as likewiſe by the metamorphoſed figure of that ſpecies of ſopewort, which, by a ſingular kind of mutation, incorporates its five petals into one. Neither are theſe the worſt effects which accrue to figure, from the variable nature of number. Even in caſes where the figure of the parts is not materially or ſubſtantially affected, by the multiplication or diminution of their number, it yet becomes virtually affected, as a ſyſtematic diſtinction. Moſt full flowers retain the figure of ſingle flowers of the ſame ſpecies. In methods, therefore, founded confeſſedly upon the figure of the petals, the place of ſuch flowers ought as readily to be aſcertained as would that of the ſame flowers in a natural ſtate. How deficient the much celebrated ſyſtem of Tournefort is, in this reſpect, will appear hereafter. At preſent, I ſhall diſmiſs the ſubject with obſerving, that the error complained of orginates in the general plan which, combining number with figure, adopts the inconveniences of each; and has gained additional ſtrength by the lax manner in which the claſſes are diſcriminated by the author, who, frequently conjoining the diſtinctions juſt mentioned, has thereby rendered the inconſtancy of either equally diſadvantageous to both.

I NOW proceed, as I propoſed, to mention ſome of the moſt conſiderable of thoſe accidental variations in the figure of the

ſeveral

ſeveral parts of plants which are totally unconnected with caſual variations of number, and unaffected by them.

THE ſtem and head of flowers of a Chineſe ſpecies of amaranthus, from a figure almoſt cylindrical, frequently aſſume that of a compreſſed and flattened ſurface.

A SIMILAR compreſſion is caſually produced in the ſtems of maiz, wild ſuccory, the larger wild valerian; as likewiſe in the branches of aſh and willow-trees. This ſingular appearance in the two laſt named plants has by ſome authors been attributed to the puncture of inſects; by others, with much greater probability of truth, to the natural grafting of two branches in the bud. From the accidental union of two embryo ſeed-veſſels in the flower-bud, or ſoon after its expanſion, ariſe the numerous twin-fruits mentioned above, which aſſume different and frequently fantaſtical forms, according as that union is more or leſs compleat. The monſtrous appearance of ſeveral leaves is probably owing to the ſame cauſe. Like variations in the form of the leaves, branches, flowers and fruit, may be obtained by artificial as by natural grafting. Of a *ſubject* deſtined to become a great tree, the pruning knife of the gardener forms a dwarf.

THE ſtems of ſpeedwell, wild orach and bird's foot trefoil, are frequently rendered ricketty by the puncture of inſects, being twiſted into a circular arch, or ſpiral form.

IN plants where the leaves, which naturally grew in pairs, are occaſionally produced by threes or fours round the ſtalk, this laſt, from being ſquare, becomes furniſhed with many ſides. That ſpecies of purple looſe-ſtrife which produces its leaves by threes, acquires a ſix-ſided ſtem.

SEVERAL leaves are ſubject to become curled; particularly thoſe of endive, a ſpecies of mallow, dock, mint, feverfew, and baſtard rocket. This ſort of monſtrous production Linnæus compares to the multiplication of petals in full flowers. It deſerves to be remarked, that the leaves of mint, coſtmary, baſil and feverfew, when curled, have their ſcent, naturally ſtrong and aromatic, conſiderably augmented.

THE leaves of a ſpecies of baſil, lettuce, and cabbage, are occaſionally covered with protuberances reſembling bladders, bliſters or warts. Thoſe of a ſpecies of ſope-wort are hollow like a ſpoon.

IN enumerating the variations incident to figure, let me not forget to mention thoſe ſingular productions which cover the leaves and branches of many trees, and are generally known by the name of galls. Theſe accidental tumours owe their origin to the puncture of certain inſects, which, depoſiting their eggs under the bark, occaſion an extravaſation of the ſap that is more or leſs abundant, according to the greater or leſs extent of the puncture. The gall-nuts, as they are commonly called, which make a principal ingredient in the compoſition of ink, are a monſtrous production of this kind formed upon the leaves of the oak. Willow-trees produce galls upon the nerves of the leaves; elms, and limes, upon their ſurface; aſpen-tree and ſcarlet oak, upon their pedicle or foot-ſtalk. In this laſt, the tumours in queſtion incloſe a ſubſtance, which is of a deep red, and when dried, proves the kermes or ſcarlet-paſtel of the ſhops. M. de Reaumur has indubitably proved that theſe protuberances are occaſioned by a ſort of bugs reſembling thoſe which infeſt our ſtoves. Theſe, fixing upon the branches of the ſcarlet oak,

nouriſh themſelves with its ſubſtance, grow in the particular ſpot to which they are attached, and do not abandon it whilſt they ſubſiſt. Upon the ſurface of the leaves of a ſpecies of ſage, are formed excreſcences, which being very palatable, are expoſed to ſale in the Levant, by the name of ſage-apples. Tournefort, who is my author, relates that theſe apples are round, nine or ten lines in diameter, aſh-coloured, ſpungy, and filled with a white pulp or fleſh, that is ſomewhat tranſparent, ſweet, and of a very agreeable taſte. The leaves of elm-trees frequently produce bladders of the ſize of a nut, incloſing a number of inſects or grubs and a thickened balmy aſtringent juice which is eſteemed ſalutary in wounds. Of galls or tumours which grow upon the branches, examples are afforded by thoſe ſingular concretions, termed Bedeguar, produced by a kind of fly upon the wild roſe. The productions in queſtion are covered with green, yellow, or reddiſh filaments; they afford nouriſhment to the worms which iſſue from the eggs depoſited in them, and produce flies ſimilar to thoſe from which they are originally ſprung. Appearances reſembling thoſe that have been mentioned are frequently found upon the leaves of ground-ivy, ciſtus, and a certain ſpecies of hawk-weed. To the ſame head may likewiſe be referred the mock-roſes of a ſmall aquatic willow, and thoſe ſingular excreſcences in form of a cup which occaſionally invade the ſtem and branches of fir-trees.

The footſtalk that ſupports the catkin or head of flowers of the oak is ſometimes found covered with galls.

In Hungarian ſpeedwell, wild valerian, a ſpecies of water hore-hound, elder, braſſica, ſow-thiſtle and cow-parſnep, the leaves are found incidentally to vary from broad to narrow.

THE ſcales of the ſpike of flowers of a ſpecies of plantain, called *plantago roſea*, by a ſingular ſort of luxuriance, are lengthened into leaves.

A SIMILAR enlargement is ſometimes obſerved in the ſcales of the catkins of fir, and roſy willow; as alſo in the glumes or huſks of ſeveral Alpine viviparous graſſes. In the former, the ſtamina and piſtils are totally deſtroyed by inſects, which therefore may not improperly be regarded as agents of the metamorphoſis in queſtion. In the latter, the huſks, converted into leaves of the ſame conformation with thoſe of the culm or ſtem, poſſeſs alſo their ſingular property of re-producing themſelves and perpetuating the ſpecies.

IRREGULAR flowers are ſometimes changed into others more regular. Such is the ſingular tranſformation of toad-flax, in Sweden, into the plant called *peloria:* ſuch likewiſe is the change effected in the ſemi-florets of a ſpecies of corn-marigold, all of which are converted into florets.

ON the contrary, ſome regular flowers are metamorphoſed into irregular. Examples of this variety are furniſhed by ſun-flower, marigold, feverfew, and thoſe other compound flowers which are rendered full by the multiplication of the ſemi-florets of the ray, and total excluſion of the florets of the diſk.

THE ſeeds of ſome graſſes, of rye in particular, are frequently prolonged into an appearance reſembling a horn or cock-ſpur. Theſe monſtrous productions, ſome of which are above two inches long, are black without, of a fungous ſubſtance, ſomewhat hard, and, as it were, cartilaginous. Bread made of rye

diſeaſed in this manner is ſaid to be productive of very dangerous conſequences, and particularly of that diſeaſe which is known by the name of *dry gangrene*. A French author, whom I have now before me, attributes the great prevalence of this diſtemper in Artois, a province of France, for two ſucceſſive years, from 1764 to 1766, to the common uſe of corn prepared of vitiated ſeeds of this kind. He adds, that rye-ſeeds which are much infected with this vice, ought not to be uſed till long after harveſt, and till, by ſweating, they have, in a great meaſure, expelled their pernicious quality. This diſtemper, termed by botanical writers, *clavus*, is moſt common in moiſt and rainy ſeaſons, and ſeems principally owing to a defect of perſpiration. Perhaps, likewiſe, a defect in fecundation, may properly enough be conſidered as the ſecondary cauſe.

Upon the ſtamina of the oak is ſometimes diſcovered a ſort of galls which are ſoft and coloured, and might be miſtaken for fruit.

The ſtamina of turpentine-tree frequently aſſume the appearance of bladders in the form of two horns, which, upon inciſion, diſcloſe a number of inſects, together with a turpentine or reſinous juice that is perfectly clear.

In double and full flowers, the ſtamina may be ſaid to undergo a change of figure; being, in fact, by their unnatural extenſion, metamorphoſed into petals: partially in the former; totally in the latter.

The piſtil and ſeed-bud are liable to transformations of various kinds. In the full flowers of cherry-tree, the embryo

ſeed-veſſel.

ſeed-veſſel frequently ſhoots up into two ſmall pointed leaves. Some roſes and anemonies occaſionally exhibit a very ſingular appearance: the piſtil being changed into a branch that overtops the flower, and is covered with leaves. M. Duhamel mentions a young pear-tree which he ſaw in the garden of a convent at Paris that was ſtill more ſtrikingly luxuriant. It was loaded with pears, the greater part of which protruded from their eye, a branch or a flower; nay ſome of thoſe flowers, ſo protruded, having knit their fruit, produced a double pear, one iſſuing out of the extremity of the other. Inſects render full a ſpecies of thiſtle by augmenting the ſize of the florets, and converting the piſtils into leaves. But the moſt common transformation of the piſtil is that into another flower exactly ſimilar to the parent-flower, within which it is produced, and fructifies. Examples of this mode of luxuriance, termed by Botaniſts, *prolification*, are afforded, in great abundance, by pink, ranunculus, anemony, and roſe.

I HAVE done with this ſubject, and ſhall only obſerve, that, from the ſeveral facts which have been collected on this head for the information of the reader, two conſequences are evidently deducible. The one, that figure, in general, is not a more infallible diſtinction than number. The other, that more frequent variations are exhibited by the petals in point of number, than of figure. Had Tournefort, therefore, in adopting the figure of the petals for his primary diſtinction, preſerved it totally unconnected with every other, he would thereby have imparted to his method a degree of excellence abſolutely unattainable by that of Rivinus, from the greater inconſtancy of its principle or leading character. Far, however, from availing himſelf as he ought, of ſo diſtinguiſhed an advantage,

advantage, the French Botaniſt has overlooked it altogether; and, by combining number with figure, and even poſtponing the latter to the former, has introduced into his method the inconveniences of either diſtinction, and thus rendered the execution of his plan more exceptionable than that of his predeceſſor, and widely different from what would have reſulted from a developement of the ſame principle cloſely adhered to.

HAVING premiſed thus much concerning Tournefort's principle, and ſhewn in what reſpects it is ſuperior, in what inferior to that of Rivinus, I proceed to a particular analyſis of his method. It ſets out with a revival of the uncertain, inſufficient and badly aſcertained diſtinction into herbs and trees: a diſtinction which, after having infeſted every botanical ſyſtem and nomenclature ſince the infancy of the ſcience, had juſt been exploded by Rivinus, as totally incompatible with that ſimplicity, facility and uniformity which ought to characterize every mode of arrangement. The ſcheme conſiſts of twenty-two claſſes; the firſt ſeventeen of which are occupied by herbs and underſhrubs; the five laſt by trees and ſhrubs. Each branch is ſubdivided from the preſence or abſence of the petals. Upon this ſubdiviſion I have only to obſerve, that the diſtinction into petal-bearing and petal wanting plants, has been already fully explained in the former ſection, and its fallibility in conducting to the knowledge of plants clearly demonſtrated. Herbaceous vegetables whoſe flowers are furniſhed with petals occupy the firſt fourteen claſſes, which are again ſubdivided from the *ſimplicity* or *compoſition* of the flowers: terms which require no explanation in this place. Simple flowers, which form eleven claſſes, are ſubdivided into ſuch as have one petal, and ſuch as

have more petals than one: and theſe diviſions are again ſeverally ſubdivided from the regularity or irregularity of the flowers. The two firſt claſſes of the method conſiſt of ſimple, regular flowers of one petal, and ſtand diſtinguiſhed by their figure, which, in the firſt, reſembles a bell; in the ſecond, a funnel. Bell-ſhaped flowers, according to our author, are of various kinds. Thoſe properly ſo called are nearly of equal width throughout. From this ſtandard depart many of the plants which are made to arrange themſelves under the claſs in queſtion. Some have the body of the flower more lengthened, and the bottom much narrower than the mouth or opening: others, on the contrary, have the opening contracted, the body and bottom gradually enlarged. Funnel-ſhaped flowers, which conſtitute the ſecond claſs, admit of equal latitude. They are divided, like the former, into thoſe properly, and thoſe improperly, ſo called. The firſt are conical at their upper extremity, and tubular below. Thorn-apple, and marvel of Peru, furniſh examples. Thoſe improperly ſaid to reſemble a funnel are of two ſorts: *ſalver-ſhaped*, which have a ſhorter tube, and a flat, ſpreading limb or border; and *wheel-ſhaped*, which have the limb flattened or placed in an horizontal poſition, and want the tube altogether. The former are exemplified in periwinkle and primroſe; the latter in borrage, bugloſs, and mullein. Simple, irregular flowers of one petal occupy the third and fourth claſſes, which ſtand diſtinguiſhed by the particular mode of irregularity that is proper to each. Thoſe of the third claſs, the author deſigns by the general but vague name of *anomalous* or *irregular*; their forms being too various to admit of a more determinate appellation. To this claſs, among others, equally irregular, are referred all thoſe plants which have a gaping or grinning petal that, in figure, reſembles the

head

head or ſnout of ſome animal: ſuch are calves ſnout, toad-flax, milk-wort, red-rattle, and *juſticia*. Examples of other irregular flowers pertaining to this claſs, are cuckow-pint, dragons, birth-wort, trumpet-flower, fox-glove, butter-wort, and bear's breech. The characters of the lip-flowers, which compoſe the fourth claſs, are more exactly aſcertained. They correſpond to the *flowers growing in whorls round the ſtem* of Ray, and are formed of a tube commonly ſomewhat curved, which widens gradually upwards into two larger portions or diviſions reſembling lips, that are again ſeverally ſubdivided into two or more leſſer pieces. The upper lip in many of theſe flowers, particularly ſage, clary, ſkull-cap and *dracocephalum*, is arched like a helmet: in ſome, as dead nettle, mint, ſtinking hore-hound, and mother-wort, it is hollowed like a ſpoon; in others, as balm, roſemary, thyme, lavender, vervain, hyſſop, and betony, it is erect; and in the various ſpecies of germander ſeems totally wanting. I ſay ſeems, becauſe there is no actual privation of the part in queſtion. It is ſplit longitudinally downwards to the very bottom; and the diviſions, ſtanding remote from each other towards the ſides, leave a vacuity where the upper lip is generally ſtationed, and thus occaſion the deception. The diviſions of the lower lip aſſume, in different plants, different appearances. In hyſſop, the middlemoſt of the three ſections is larger than the other two, hollowed like a ſpoon, and ſubdivided into two parts which terminate in a point. In lavender, the three diviſions are almoſt equal and round. The other characters aſſigned to this claſs by our author are, a tubular calix of one piece, and four naked ſeeds which are lodged and ripen in the bottom of the cup, as in their proper *uterus* or receptacle.

We have now exhauſted the claſſes containing ſimple flowers of one petal; and proceed to the next diviſion, containing ſimple flowers of two or more petals. This, like the former, is ſubdivided from the regularity and irregularity of the flowers, and comprehends ſeven claſſes. The fifth, ſixth, ſeventh, eighth and ninth claſſes conſiſt of ſimple regular flowers which have more petals than one, and are diſtinguiſhed by their general ſymmetry and figure, as follows. In the fifth, which correſponds to the twenty-firſt of Ray and fourth of Rivinus, the flowers conſiſt of four equal petals that ſtand upon long claws, and are diſpoſed at top in form of a croſs. The flower-cup too, is compoſed of four diſtinct leaves which are diſpoſed like the petals, and generally fall off with the flower. The fruit is that kind of pod termed *ſiliqua*. Examples of croſs-ſhaped flowers are furniſhed by ſtock, braſſica, muſtard, celandine, and ſcurvy-graſs. Several equal petals, diſpoſed circularly like a roſe, characterize the ſixth claſs; which is exemplified in poppy, St. John's wort, ſaxifrage, pæony, anemony, and ranunculus. The umbelliferous plants conſtitute the ſeventh claſs. Theſe, which form the eleventh claſs in Ray's method, are deſcribed by our author to have a *roſaceous* flower of five petals, which are frequently unequal, and in form reſemble a *fleur-de-lis*; and a fruit compoſed of two naked ſeeds which adhere cloſely together in their immature ſtate, but ſeparate when ripe. To the general obſervations made in the foregoing ſection reſpecting that diſpoſition of the flower-ſtalks which has procured the name of *umbelliferous* to the plants in queſtion, the following may ſerve as a ſupplement. Independently of the proper calix of each floret, flowers that grow in an umbel have a kind of common calix which is ſtationed at the baſe of the rays either of the univerſal or partial umbel, or both. In

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the former caſe, it is termed an univerſal *involucrum* or cover; in the latter, a partial one. Theſe covers or wrappers, as they are improperly called, admit of as great variety of ſtructure as the flower-cups of other plants. Neither is that ſtructure ſcarce ever alike in the different covers of the ſame umbel. In hare's ear, the univerſal cover conſiſts of an indeterminate number of leaves; the partial of five only. In angelica and lovage, the univerſal cover is compoſed of three or five leaves in the former, of ſeven in the latter: the partial, on the other hand, conſiſts of eight diſtinct pieces in the firſt; of four, and thoſe not very clearly aſcertained, in the ſecond. Sanicle is furniſhed with an univerſal cover which goes but half way round the general umbel; whilſt the partial cover entirely ſurrounds the ſecondary umbel, at the foot of which it is placed. The reverſe of this happens in cow-parſnep, coriander, and fool's parſley; in which the partial cover but half ſurrounds its correſponding umbel, and the univerſal cover compleats its circuit. In the eighth claſs, the flowers are compoſed of five regular petals which emerge from the bottom of a cylyndrical calix that is of one piece, and diſpoſe themſelves in a circular form upon its margin or brim. Lychnis, carnation and ſea-pink furniſh examples. The liliaceous plants conſtitute the ninth claſs: the characters of which are; regular flowers, commonly of ſix petals, ſometimes of three, or even of one deeply divided into ſix parts; and a capſular fruit with three cells, each containing ſeveral ſeeds. Aſphodel and hyacinth afford examples of the divided petal alluded to; flower-of-a-day has three petals; tulip, lilly, and ſpider-wort, ſix. Irregular flowers of more petals than one occupy the two next claſſes, which ſtand thus diſtinguiſhed. Under the tenth are arranged the pea-bloom, papilionaceous or butterfly-ſhaped flowers. Theſe have already been fully deſcribed in the correſponding

claſs

claſs of Ray, who, in his improved method, has borrowed from our author the diſtinctive character of the leguminous plants. The eleventh claſs, like the third, is miſcellaneous. It contains ſuch anomalous or irregular flowers with many petals as do not rank with the pea-bloom flowers juſt mentioned, nor, by reaſon of their great diverſity in form, can be comprehended under one general appellation. Among many others, violet, lark-ſpur, aconite, orchis, and ladies ſlipper may be adduced as examples.

THE compound flowers, which form the ſecond great diviſion of petal-bearing plants, acknowledge the ſame principle of diſtribution in the method now before us, as in thoſe of Rivinus, Ludwig and Chriſtian Knaut. In the twelfth claſs, the florets are all regular, funnel-ſhaped, and ſlightly cut on the borders into ſeveral equal diviſions. Theſe are the *floſcular* flowers of our author, of which, thiſtle, and the other plants whoſe aggregate reſembles the artichoke, furniſh examples. The flowers of the thirteenth claſs are termed *ſemifloſcular*; being entirely compoſed of ſemi-florets, a ſort of irregular florets, which differ from thoſe properly ſo called, in having a narrow tube below, which widens upwards into a flat expanſion reſembling a tongue, that is indented at its extremity. Sow-thiſtle, hawk-weed and dandelion are familiar examples. When both florets and ſemiflorets are united in the ſame flower, the former occupy the centre, termed the diſk; the latter, the margin or circumference, ſtiled generally the ray, and by Tournefort, the crown. The form of theſe flowers has obtained them the name of *radiated*. They conſtitute the fourteenth claſs in the method under review, and are exemplified in ſun-flower, aſter, and corn-marigold.

HERBACEOUS

HERBACEOUS plants which want the petals come now to be ſubdivided. Theſe are contained in three claſſes, which ſtand primarily diſtinguiſhed from the preſence or abſence of the flower. Petal-wanting plants, properly ſo called, occupy the fifteenth claſs. In theſe, the petals only are wanting; the ſtamina and piſtil, eſſential parts of the flower, ſtill ſubſiſt. To this claſs, beſides many other plants, confeſſedly *apetalous*, is referred the numerous tribe of graſſes, which are judged deficient in the petals both by our author, and by Mr. Ray in his improved method, becauſe the inner huſky covers ſurrounding the flower, by ſome Botaniſts termed petals, perform the office of a calix in enveloping the fruit, and accompanying it to maturity. The imperfect plants of Ray are contained in the two ſubſequent claſſes, the diſcriminating character of which is the preſence or apparent abſence of the fruit. In the ſixteenth claſs, the fruit is preſent, the flowers reputed to be wanting. Under this head is collected the numerous tribe of ferns, which bear an appearance reſembling ſeeds, that are commonly diſpoſed upon the back of the leaves; ſometimes, however, as in royal oſmund, upon a pedicle or footſtalk that overtops them. Notwithſtanding our author's diſtinctive character of this ſpecies of *imperfect* plants, it appears, from more recent obſervations, that ſome of the ferns are furniſhed with genuine ſtamina; nay, it ſtill admits of a doubt, whether thoſe appearances vulgarly called ſeeds, may not, with equal juſtice, be entitled to the ſame appellation. Plants, in which neither the flowers nor fruit are apparent, conſtitute the ſeventeenth claſs, and cloſe the firſt branch of the method, that containing underſhrubs and herbs. Moſſes, muſhrooms and ſea-weed arrange themſelves under the claſs in queſtion. The ſtamina and ſeeds of many of theſe plants have been detected ſince the time of Tournefort, who,

who, himſelf, by analogy, ſuſpected their exiſtence, and has therefore characterized the claſs under review, from the apparent, not the real or aſcertained, abſence of the flower and fruit. In ſome moſſes, as *lycopodium*, *hypnum*, and water-moſs, the flowers producing the ſtamina grow upon the ſame plant with thoſe which produce the capſules or cones, and ſtand above them; in golden maiden hair, each kind of flower is produced on diſtinct plants; in *mnium* and *bryum*, they are placed apart, ſometimes on the ſame, ſometimes on different roots. It deſerves to be remarked, that the ſtamina of the moſſes want the filaments or threads altogether; and that they are ſometimes ſeated immediately upon the branches, as in *lycopodium* and water-moſs; ſometimes elevated by a long pedicle or footſtalk, as in golden maiden hair and *bryum*. Over the ſtamina is ſuſpended a ſort of cover reſembling a monk's cawl, which with modern botaniſts paſſes for the flower-cup, and is denominated *calyptra*, a hood or veil.

TREES and ſhrubs are ſubdivided, like herbaceous vegetables, from the preſence or abſence of the petals. The eighteenth and nineteenth claſſes conſiſt of woody plants which have no petals. Thoſe of the eighteenth, termed petal-wanting trees properly ſo called, may be referred to their particular diviſion with the ſame facility as herbaceous plants of a ſimilar deſcription. The flower and fruit in thoſe apetalous trees are either contiguous, as in aſh and carob-tree; placed remote from each other upon the ſame individual plant, as in box and berry-bearing heath; or ſeparated upon diſtinct plants produced from the ſame ſeed, as in gale, turpentine-tree and fig. Aſh-trees, however, do not always want the petals, neither have they the ſtamina at all times united to the fruit: on the contrary,

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the flowers are ſometimes furniſhed with four long erect petals; and the ſtamina, frequently imperfect, are ſometimes totally wanting. In the nineteenth claſs, the flowers which produce the ſtamina are attached in a bundle or heap round a common footſtalk or long ſlender receptacle that is covered with an infinity of chaffy ſcales for ſeparating the flowers, and, from its fancied reſemblance to a cat's tail, has obtained, in Latin, the name of *catulus*, in French, *chaton*, and in Engliſh, catkin. The terms *nucamentum*, *julus* and *amentum* are uſed by other writers to expreſs the ſame appearance, which by Linnæus is defined to be a ſingular compoſition of a calix and a common receptacle. By the character juſt given, the plants of this claſs may always, with certainty, be diſtinguiſhed from thoſe of the former. In the flowers too that grow in catkins, the ſtamina are always ſeparated from the fruit, either upon the ſame plant, as in walnut, hazel, oak, beech, fir, birch, and plane trees; or upon diſtinct plants, as willow and poplar. In juniper, cedar, yew, and mulberry, the flower and fruit are ſometimes produced upon the ſame, ſometimes upon different individuals. Trees whoſe flowers are furniſhed with petals occupy the three laſt claſſes of the method, which, like petal-bearing herbs, ſubdivide themſelves from the number of petals of which the flowers conſiſt. The twentieth claſs affords a numerous aſſemblage of ligneous plants with flowers of one petal that is generally regular. Privet, olive, elm, lilac, elder, honey-ſuckle, and miſletoe furniſh examples. Polypetalous trees are divided into ſuch as have regular, and ſuch as have irregular flowers. To each diſtinction is allotted a ſeparate claſs. Trees with regular flowers of more petals than one occupy the twenty-firſt claſs. The flowers are all of the kind termed *roſaceous*, being compoſed of many equal petals, which

are diſpoſed circularly, in form of a roſe. This claſs, whoſe diſtinguiſhing character is that of the ſixth in the ſame method, is exemplified in ſumach, lime, berberry, mock-orange, ſpiræa, bonduc, apple, almond, roſe, medlar, and pomegranate. The fifth claſs of trees and ſhrubs, and laſt of the method, conſiſts of woody plants with irregular flowers of four or five petals, which, in form, reſemble a butterfly. Some of the plants referred to this claſs bear leaves that are ſimple and alternate. Such are judas-tree and the different kinds of broom. In a few, as laburnum and coral-tree, the leaves reſemble thoſe of trefoil; in falſe acacia, bladder ſenna, *coronilla* and *barba jovis*, they are pinnated or winged; that is, conſiſt of a number of ſmaller leaves that are arranged in pairs, along a common footſtalk.

I HAVE been thus particular in illuſtrating the general ſcheme of this juſtly-celebrated method, not only out of reſpect to the diſtinguiſhed character of its author, but becauſe ſeveral of the claſſes are properly his own, and poſſeſs a degree of facility that could ſcarce have been expected in a plan of arrangement, which ſeems to have propoſed the inveſtigation of natural families as the ſtandard of excellence. Rivinus made choice of a principle which, being obſerved with the moſt ſcrupulous exactneſs, had totally excluded every natural aſſemblage, whether of a primary or ſecondary kind. It was Tournefort's intention, in adopting a principle that admits of greater latitude, to reſtore its imagined utility to the ſcience, by re-eſtabliſhing, as far as the artificial character would permit, thoſe natural claſſes and genera, which Rivinus, preferring facility to every other advantage, had diſmembered and ſplit.

THE merits of Tournefort's method as a botanical nomenclature, and its difficulty or eaſe in conducting to the knowledge

of plants, come now to be particularly diſcuſſed. That the reader may be qualified to decide with accuracy upon this ſubject, I ſhall, as uſual, preſent him with a familiar example, which, from a previous knowledge of the diſtinctions that have been mentioned, he may, with ſome aſſiſtance, refer to its proper diviſion in the method; and, from the facility or difficulty of ſuch reference, form a juſt eſtimate of the facility or difficulty of the arrangement in queſtion. Let monkſhood, a well-known garden plant, be the propoſed example. I am required to aſcertain its preciſe place in the method before us. In this inveſtigation we are to proceed ſtep by ſtep in the order of the method, and eſtabliſh the propriety or impropriety of each diſtinction, as we go along. To which then of the two primary diviſions, or grand branches of the method, is the plant juſt mentioned, to be referred? In other words, is it a tree, or an herb? Every one, the leaſt converſant with plants, would bluſh to heſitate a moment in returning an anſwer to theſe queries; and yet certain it is, that there are not ſufficient data for their ſolution; neither can ſatisfactory reaſons be aſſigned for referring the plant in queſtion to one branch of the method, in preference to the other. Monkſhood paſſes for an herb. Is it not then to be referred to that diviſion of the method which contains underſhrubs and herbs? Certainly, if it poſſeſſes the diſtinctive characters of that diviſion; and thoſe characters are ſufficient, adequate, and properly aſcertained. But the diſtinction into herbs and trees has been proved to be of all others the moſt fallible and deceptive; the plant therefore to be explored, may be made to arrange itſelf, with almoſt equal certainty, under either diviſion. The limits thus vague and undetermined, what remains for the novice in Botany, but perpetual miſtakes, ariſing from the inſufficiency of the leading

characters? In vain do the advocates of this unmethodical diſtinction urge the different conſiſtence, duration and height of the ſtem; each character, after undergoing the ſtricteſt and moſt minute examination, has been concluded highly inadequate, and, in particular inſtances, extremely fallacious. Neither is the facility only of a Botanical method affected by the uſe of a diſtinction that is ſo little in the ſpirit of genuine ſcientific arrangement. Simplicity and uniformity are affected in an equal degree; and hence the beauty of every ſuch method is always greatly impaired, often totally loſt. The five ſuperfluous claſſes which the uſe of this diſtinction has introduced into the ſyſtem of Tournefort, are an unſpeakable blemiſh. They conſtitute a diſtinct branch of the method, and yet acknowledge the ſame principle of diſtribution with an equal number of claſſes in the other branch. It has often to me afforded matter of wonder that a diſtinction ſo indefinite, and inaccurately aſcertained as that into trees and herbs ſhould ever have been thought proper to be employed as the foundation or primary diſtinction of a natural method. The relations that incorporate plants into natural families, are not only exceedingly diverſified in point of number, but have their limits ſo accurately and preciſely determined, that the individuals of one family or tribe are in no danger of being obtruded upon thoſe of another. That herbs and trees may generally be recognized by ſight, I readily allow: neither do I deny, that the relations which ſerve to approximate the plants of either claſs, are ſufficiently numerous: but theſe relations are withal ſo vague and undetermined, that the aſſemblages to which they give riſe can never with juſtice be accounted genuine natural claſſes. Beſides, why ſhould it be reckoned unnatural to arrange herbs with trees, when examples of ſuch arrangement are ſo common in nature? Herbaceous

plants

plants grow indiſcriminately with trees and ſhrubs. The pimpernel is produced at the foot of the oak; bryony twiſts about the hawthorn. Why ſeparate things which nature has conjoined? Why refuſe to obſerve the ſame indiſcriminate arrangement of which ſhe has afforded us ſo diſtinguiſhed an example?

A ZEALOUS admirer of Tournefort will not fail to accuſe me of partiality, and even to inveigh with ſome acrimony againſt a repreſentation ſo injurious to the character of his favourite author. "It is not credible, I ſhall be told, that doubts ſuch "as thoſe which have been ſuggeſted, ſhould ever poſſibly "ariſe. I mean not," continues my antagoniſt, "to aſſert the "infallibility of ſcientific diſtinctions of any kind. Miſtakes "are frequently unavoidable. But would you ſeriouſly convince "me that any one is in danger of miſtaking monkſhood for a "tree, or poplar for an herb?" Not whilſt you labour under ſuch violent prejudices, do I hope or endeavour to convince you: but would you diveſt yourſelf of thoſe prepoſſeſſions, ſo unbecoming a philoſopher, would you coolly and diſpaſſionately join with me in the inveſtigation of truth, would you, forgetting for a moment your own ſuperior knowledge, put yourſelf in the room of a mere novice in the ſcience, I ſhould not deſpair of producing a total change in your opinion, ſpeciouſly ſupported as it at preſent appears. The excellence of every Botanical nomenclature conſiſts in the facility wherewith it conducts to the knowledge of plants. In fact, a method, to be perfect, muſt exactly reſemble a dictionary. The initial letters of the words are repreſented by the claſſes or primary diviſions: the ſucceeding letters, each in its order, by the ſeveral ſubdiviſions of the claſs, namely, orders, genera, ſpecies

and

and varieties. That a dictionary may be uſeful, the order of the alphabet muſt previouſly be aſcertained. That a Botanical method may be uſeful, the order of the claſſes, and the characters of each muſt be accurately determined. A novice in grammar cannot make uſe of a dictionary, whilſt he remains ignorant of the order of the letters. A novice in Botany cannot make uſe of a nomenclature or method, whilſt he either remains ignorant of the order of the claſſes, and the principles upon which that order is founded, or finds the diviſions of the method vague, and indefinite. The place of any word, BOTANY for inſtance, cannot be aſcertained by one, who has not previouſly informed himſelf of the rank and ſtation of the letter B. In like manner, the place of any plant in a Botanical method can only be determined in conſequence of the fulleſt information reſpecting the order of the claſſes, and aſſurances, next to demonſtration, that the diſtinctive characters of each diviſion admit not of the leaſt ambiguity or doubt: Now the diſtinction into trees and herbs has been found, upon examination, to be extremely defective in this reſpect. No limits, hitherto aſſigned, have proved, in any degree, ſatisfactory. Why then ſhall it be thought incredible that a novice in the ſcience ſhould incur the danger of arranging monkſhood with trees, or poplar with herbs, when the diſcriminating marks are ſo uncertain and equivocal, and wild conjecture muſt ſupply the place of unchangeable reality?

To illuſtrate this matter ſtill farther. In an etymological dictionary, primitive and ſimple words only are arranged in the order of the alphabet; compounds and derivatives rank themſelves each under its reſpective root. Now as many words admit of very different etymologies, ſome of them extremely fanciful,

fanciful, it is evident, that the place of ſuch words, in the general nomenclature, can only be inveſtigated by thoſe who, to a perfect knowledge of grammar, have added an entire coincidence with the lexiocographer in his notions of derivation, however whimſical and abſurd. Equally fanciful and uncertain, and therefore, equally improper to be employed in a ſcientific nomenclature, is the diſtinction into trees and herbs. It acknowledges no ſure or determinate foundation. Its characters, far from poſſeſſing that ſtability, which, to be uſeful, they require, are vague, fluctuating and ſubject to continual variations. The place therefore, of bodies ſo inaccurately diſtinguiſhed, muſt be of extremely difficult inveſtigation, and is only, in fact, to be aſcertained by thoſe who, happy in their conjectures, and unaſſiſted by any previous inſtruction, can enter preciſely into the author's ideas or no-ideas of the ſubject in every particular.

However improbable the ſuppoſition, let us ſuppoſe the difficulty, whoſe exiſtence we have been labouring to demonſtrate, totally ſurmounted, and that our young Botaniſt has been fortunate enough to refer the plant in queſtion to that branch of the method which contains underſhrubs and herbs. How does he next proceed? And what progreſs has been made in conſequence of the ſtep already taken? By the determination juſt mentioned, the five claſſes containing trees and ſhrubs are cut off, and monkſhood, the plant under examination, is adjudged to belong to one of the ſeventeen claſſes which remain. Theſe, as we have ſeen, are primarily ſubdivided from the preſence or abſence of the petals. The next queſtion, therefore, that occurs, in the order of the general ſcheme, is this: To what branch or diviſion of herbaceous vegetables does monkſhood pertain?

pertain? Is it to be claſſed with plants whoſe flowers are furniſhed with petals? Or with thoſe in which that ornamental part of the flower is wanting? The anſwer to theſe queries cannot be immediate; becauſe, upon inſpection, I find that one only of the flower-covers is preſent, and I have no certain or infallible rule for determining its appellation. If the reader has carefully peruſed that part of Ray's method which adopts the ſame inaccurate diſtinction, he will not judge any farther explanation neceſſary. I ſhall only obſerve, for the ſake of the beginning Botaniſt, whoſe advantage I would ever carefully conſult, that, in dubious caſes, like the preſent, he will do well to be determined, not ſo much by the permanency or caducity of the organ that is preſent, as by its general texture and colour. The former, I know, is Tournefort's ſole mark of diſtinction; but the learner, who confides in its infallibility, will find himſelf frequently miſtaken. On the other hand, although it is eſtabliſhed beyond a doubt, that, in plants which have both the flower-covers, the calix is ſometimes found to emulate the petals in colour, yet where one only of the covers is preſent, it is pretty generally agreed among Botaniſts, to denominate that cover, if green or colourleſs, the calix; if coloured, and of a beautiful ornamental appearance, the *corolla*, petals or flower. By this rule, which, for the purpoſe of accuracy in ſubjects of ſuch minute inveſtigation, ought to have been univerſal, the learner is enabled, with great probability of truth, to aſcertain the place of many plants which would otherwiſe, in the method before us, remain vague and undetermined. Thus, in the preſent inſtance, monkſhood is very properly referred to that diviſion of herbaceous plants whoſe flowers are furniſhed with petals, in preference to the oppoſite diviſion, becauſe the only flower-cover that is preſent, being

being coloured and highly ornamental, is with much greater propriety adjudged to be the petal, whoſe texture is fine and delicate, than the calix, whoſe organiſation is conſiderably coarſer. This difficulty being removed, the learner will proceed with rapidity and eaſe. By the deciſion juſt given, the plant is manifeſtly excluded from the fifteenth, ſixteenth and ſeventeenth claſſes, whoſe characteriſtic diſtinction is the abſence of the petals: and I have to look for it in the firſt fourteen claſſes, in which the preſence of that organ is the diſcriminating character. The diſtinction into ſimple and compound flowers, which comes next under review, is of itſelf ſo ſtriking, and hath been aſcertained with ſuch preciſion and accuracy, that the verieſt novice in the ſcience incurs no danger of miſtake. Three claſſes are cut off in conſequence of this progreſs, and our ſearch is now confined within a very narrow compaſs. The next ſtep lops off at once four claſſes more: for it is ſcarce poſſible that any one ſhould dream of aſſerting that monkſhood is furniſhed with but one petal. We have now only ſeven claſſes to diſcuſs; five of which arrange themſelves under one branch, and two under another. To which of theſe branches is the plant in queſtion to be referred? Has monkſhood a regular or an irregular flower? No one who hath acquired preciſe ideas of the terms juſt mentioned can heſitate a moment to pronounce in favour of the latter. Monkſhood, then, cannot pertain to the fifth, ſixth, ſeventh, eighth or ninth claſſes, which contain regular flowers; and is conſequently to be looked for in one of the two ſubſequent claſſes, which each contain irregular flowers with more petals than one. To the tenth claſs it cannot be referred, becauſe the papilionaceous flowers of the plants which compoſe it, can never be confounded with that peculiar irregularity which characterizes the flowers of the

plant under review. It pertains, therefore, to the eleventh claſs, which is miſcellaneous, and comprehends irregular flowers of ſuch variety of ſtructure that they cannot be contained under one general appellation.

EXAMPLES, much better calculated for diſplaying the difficulties of the Tournefortian method, might have been choſen. But I deem it illiberal, as well as highly unjuſt, to make any partial ſelection of this kind. The cauſe of ſcience, far from being promoted by ſuch miſrepreſentations, is, in the moſt effectual manner, injured and debaſed. Scientific reſearches ought never to be tinged with narrow prepoſſeſſions: and it is ungenerous to tax a whole method with imperfections, which, perhaps, are juſtly chargeable upon a very inconſiderable part. Random examples are, for this reaſon, the moſt proper for illuſtration: and ſuch are thoſe which I have conſtantly employed in illuſtrating the ſeveral methods that conſtitute the ſubject of this prefatory VIEW. On the other hand, particular defects, no leſs than particular beauties, claim a ſeparate recital. Why? For this obvious reaſon: that no improper degree of excellence or imperfection may be attributed to the general ſcheme, on account of certain excellencies or defects in any of its parts. In conformity to this plan, which I have hitherto invariably purſued, I now proceed to make a few obſervations upon the merits and defects of the method before us.

FIGURE admits of much greater latitude than number: Tournefort's method, therefore, however beautiful in the idea, is much more difficult in practice than that of his predeceſſor, Rivinus, whoſe ſole object was to facilitate the knowledge of plants. The faulty latitude of the firſt and ſecond claſſes was formerly

formerly cenſured. The third claſs is miſcellaneous, and acknowledges no particular mark of diſtinction. Many, too, of the plants that are arranged under it, might, perhaps, with equal propriety, be referred to the ſubſequent claſs. The fourth, fifth and ſeventh claſſes are accurately diſtinguiſhed. The ſixth and eighth do not poſſeſs ſufficient marks of diſcrimination. Many of the umbelliferous plants have flowers perfectly irregular, and are, therefore, improperly ſtationed under a diviſion which profeſſes to collect regular flowers only. Some of the lip-flowers, particularly mint, and water-horehound, ought, by parity of reaſon, to be removed from a diviſion which profeſſes to collect irregular flowers only. In a method purely artificial, junctions ſo inconſiſtent with the general plan, would have been pronounced, with juſtice, a capital blemiſh. In the preſent caſe, however, they are the leſs cenſurable; as the author, though ſenſible of the impropriety complained of, could not avoid committing it, without fruſtrating the very primary intention of his method, which profeſſedly combines the natural character with the artificial. In the ninth claſs is a very ſtriking defect, which owes its origin to the ſame cauſe. The liliaceous plants are made to arrange themſelves under the diviſion of regular flowers with more petals than one; and yet no leſs than ſeventeen different genera of the claſs in queſtion, are found, upon examination, to be furniſhed with one petal only. Crocus, narciſſus and hyacinth, are familiar examples of the imperfection alluded to. The compound flowers are divided in a maſterly manner: as are, likewiſe, the three ſubſequent claſſes; which contain all the herbaceous plants, whoſe flowers are deſtitute of petals. The pea-bloom flowers are very properly characterized; thoſe of the eleventh claſs, though

various in their ſtructure, are not equally vague with the plants of the third claſs, which is likewiſe miſcellaneous, becauſe they run no riſk of being confounded with the other irregular flowers of the ſame diviſion, as the *lip* and *maſqued* flowers manifeſtly do.

The ſecondary diviſions in Tournefort's method, which are a hundred and twenty-two in number, have obtained the name of ſections. Their general diſtinctions are founded principally upon the fruit; as thoſe of the claſſes are upon the flower. That the reader may be well informed upon this ſubject, I ſhall particularize the moſt remarkable of thoſe diſtinctions; and accompany each with an explanatory obſervation. The claſſes, then, are chiefly ſubdivided from an attention to the origin of the fruit; the ſituation of the fruit and flower; the ſubſtance, conſiſtence and ſize of the fruit; the number of its internal cavities or cells; the number, form, diſpoſition and uſe of the ſeeds; the diſpoſition of the flower and fruit; the figure and diſpoſition of the petals; and diſpoſition of the leaves. Of theſe in order.

I. *Of the Origin of the Fruit.*

In ſome plants, as the croſs-ſhaped flowers, the piſtil becomes the fruit; in others, as the umbelliferous plants, it is formed of the calix.

II. *Of the Situation of the Fruit and Flower.*

In flowers whoſe piſtil becomes the fruit, both flower and fruit are placed upon one common receptacle; in thoſe, on the other

other hand, whoſe calix becomes the fruit, the receptacle of the flower ſtands above the fruit, which has, for its receptacle, the extremity of the pedicle or footſtalk to which it is attached. Theſe differences in point of ſituation, which give riſe to many of the ſections in the method under review, have been differently characterized by different Botaniſts. By Cæſalpinus they were denominated *ſedes floris in ſede fructûs*, and *ſedes floris in apice fructûs*; and the terms *germen ſuperum*, *flos inferus*, *germen inferum*, and *flos ſuperus*, made uſe of by later writers, convey exactly the ſame meaning.

III. *Of the Subſtance, Conſiſtence, and Size of the Fruit.*

Some fruits are ſoft, as thoſe of butcher's broom, and deadly night ſhade; others are hard and dry, as in gentian, honey-wort and water-leaf. In gourd and cucumber, the fruit is fleſhy; in plumb, apricot and peach, it is pulpy, and incloſes a hard bony ſubſtance, which is termed the ſtone. Some fruits are large, as melon; others are ſmall, as currants.

IV. *Of the Number of Cells or Cavities of the Fruit.*

The cavity in ſome capſular fruits, as primroſe, is entire and undivided; in others, it is internally divided by partitions, termed by Botaniſts *diſſepimenta*, into two or more cells. Tobacco and thorn-apple have two cells; lilly and hyacinth, three; ſpindle-tree, four; winter-green, five; birth-wort, ſix; leaſt rupture-wort, eight; moſt ſpecies of flax, ten; water-lilly, many.

V. *Of the Number, Form, Diſpoſition and Uſe of the Seeds.*

In point of number, ſeeds are exceedingly diverſified. Sea-pink and biſtort are furniſhed with only one ſeed; the umbelliferous plants, and thoſe whoſe leaves grow in whorls round the ſtem, have two ſeeds; ſpurge has three; the lip-flowers, four; ranunculus, anemone and poppy, an indefinite number.

Equally various is their form or external figure, which, in different ſeeds, is round, oval, flat, kidney-ſhaped, angular, ſmooth, wrinkled, large or ſmall.

Some ſeeds, particularly thoſe of the compound flowers, are furniſhed with a ſort of downy crown, which is either ſimple and unbranched, as in colt's foot, groundſel, and hawk-weed; or branched like a feather, as in dandelion, hemp-agrimony, and cudweed. The crown in queſtion, termed by Botaniſts *pappus*, is either placed immediately upon the top of the ſeed, without the intervention of any pedicle, as in hawk-weed, thiſtle, and ſaw-wort; or is elevated upon a ſlender thread or footſtalk, which connects it with the ſeed, as in dandelion, lettuce and colt's foot. The footſtalk alluded to has obtained the name of *ſtipes*. It will not be improper, once for all, to obſerve, that the wings and crowns which ſurmount ſeveral ſeeds, are not ſolely deſtined for ornament; being manifeſtly deſigned by Nature to facilitate the diſperſion of the ſeeds for the purpoſe of increaſe.

The graſſes are ſubdivided, by Tournefort, from the diſpoſition of their ſeeds, which is frequently in the form of a ſpike; and from the uſe to which many of them, particularly wheat, rye, barley and oats, are daily employed in domeſtic œconomy.

VI. *Of the Diſpoſition of the Fruit and Flower.*

THE fruit is ſometimes ſeparated from the flower upon the ſame plant, as in walnut and cheſnut; ſometimes upon different plants, produced from the ſame ſeed, as in hemp, juniper and butcher's broom.

VII. *Of the Figure and Diſpoſition of the Petals.*

WHEN the preceding characters, drawn from different circumſtances of the fruit, appear inſufficient for diſtinguiſhing the ſections, the author has recourſe to a few auxiliary characters, from the figure of the flower; totally diſtinct, however, from thoſe which ſerved to diſcriminate the claſſes.

OF the funnel-ſhaped flowers, ſome are in the form of a ſalver, as primroſe and *androſace*; others reſemble a wheel, as borrage, night-ſhade and pimpernel.

OF the irregular flowers of one petal which conſtitute the third claſs, the greater number reſemble the head or ſnout of ſome animal: ſome are formed into the ſhape of an ear, as cuckow-pint and dragons; others are tubular, and terminate in a tongue, as birth-wort.

VIII. *Of the Diſpoſition of the Leaves.*

THIS character is employed by our author in only two claſſes, the tenth and twenty-ſecond, which each contain papilionaceous or butterfly-ſhaped flowers.

OF

Of the plants juſt mentioned, ſome have their leaves compounded of three diſtinct leſſer leaves, connected to a common pedicle, as trefoil and laburnum; in others, as falſe acacia, and bladder ſenna, they are compoſed of a number of ſmaller or partial leaves, which arrange themſelves, either oppoſitely or alternately, along both ſides of a common footſtalk. The former kind of compound leaf is denominated *ternate* or *trifoliate*; the latter, *pinnated* or winged.

I SHALL diſmiſs this celebrated method, after having preſented the reader with a liſt of the moſt conſiderable writers who have adopted it.

DR. William Sherard, an eminent Botaniſt of the laſt and preſent centuries, publiſhed at Amſterdam, in 1689, the firſt ſketch of Tournefort's method, under the title of *Schola Botanices*; or, a Catalogue of the Plants demonſtrated by Dr. Tournefort, in the Royal Gardens at Paris. It was not till five years after, that the *Elementa Botanica*, a work which contains the rudiments and illuſtration of his method, was publiſhed by Tournefort himſelf.

FATHER Plumier, termed, by way of eminence, the Tournefort of America, publiſhed, in 1703, at Paris, a deſcription of American plants, which he has arranged according to the ſyſtem of Tournefort. In the work alluded to, the ingenious author has accurately characterized ninety-ſix new genera.

FALUGI, an Italian, has deſcribed, in pretty elegant Latin verſe, all the genera of Tournefort, in a work entitled, *Proſopopœiæ Botanicæ*, publiſhed at Florence, 12mo. in 1705.

SEVERAL celebrated French academicians, particularly Marchant, Dodart, Niſſole, Juſſieu and Vaillant, have occaſionally paid their tribute of acknowledgment to the author whoſe method we have been analyſing, in the Memoirs of the Academy of Sciences at Paris, from 1700 to 1740.

THE other authors of note who have followed Tournefort's method, are M. Petit, an ingenious French Botaniſt; Johren, a German, author of a treatiſe publiſhed at Colberg, in 1710, entitled *Vade Mecum Botanicum ſeu Odegus Botanicus*; Feuillé, in his Deſcription of the Plants of Chili and Peru, publiſhed at Paris, in quarto, in 1714; Chriſtopher Valentin, a German, author of a book entitled *Tournefortius Contractus*, publiſhed at Francfort, in folio, in 1715; Ripa, an Italian, in a work entitled *Hiſtoriæ Univerſalis Plantarum Conſcribendi Propoſitum*, publiſhed in quarto, at Padua, in 1718; Michael Valentin, a German, in his *Viridarium Reformatum*, publiſhed in folio, at Francfort, in 1719; the celebrated Dillenius, profeſſor of Botany at Oxford, and author of ſeveral much eſteemed publications, particularly the *Hortus Elthamenſis*, and Hiſtory of Moſſes, in his *Flora Giſſenſis*, printed at Francfort, in 1719; Pontedera, an Italian, author of the Delineation of a Method which combines thoſe of Tournefort and Rivinus, publiſhed at Padua, in his Botanical Diſſertations, in 1720; Monti, an Italian, in a work publiſhed at Bologna, in 1724, under the title of *Indices Plantarum Varii*; Lindern, a German, in his *Tournefortius Alſaticus*, firſt publiſhed in 1728; the ingenious Signior Micheli, author of ſeveral curious diſcoveries reſpecting moſſes and muſhrooms, in his *Nova Genera Plantarum*, publiſhed in folio, at Florence, in 1729; Elvebemes, a Swede, in a work publiſhed in the Swediſh language, at Upſal, in 1730;

Fabricius, a German, author of a work entitled *Primitiæ Floræ Butiſbacenſis, ſeu ſex Decades Plantarum Rariorum*, publiſhed in 1743; Sabbati, an Italian, in his Catalogue of the Plants that grow in the Neighbourhood of Rome, printed at Rome, in 1745; and the ingenious Dr. Charles Alſton, late profeſſor of Botany at Edinburgh, in his *Tyrocinium Botanicum*, publiſhed at Edinburgh, in 1753.

Of all this numerous liſt of writers, Father Plumier and Pontedera alone, have ventured to quit the track pointed out by Tournefort. The former in his arrangement of American plants, has relinquiſhed the inſufficient diſtinction into herbs and trees. The latter has attempted more conſiderable variations. Inſtead of the French Botaniſt's primary diſtribution of vegetables into herbs and trees, he has ſubſtituted the equally inaccurate diſtinction employed by Ray, from the preſence or abſence of the buds. The petal-wanting flowers, properly ſo called, of Tournefort, he characterizes by the name of imperfect. Thoſe which want the petals and ſtamina, but not the ſeeds, form the ſecond claſs, by the name of plants that are devoid of flowers. The muſhrooms and moſſes, which by Tournefort are characterized from the abſence of both flower and fruit, conſtitute the firſt claſs in Pontedera's method, under the name of Plants of an Uncertain Deſcription. The claſs containing funnel-ſhaped flowers, is very properly ſplit by our author into three claſſes, which correſpond to the different modifications of the funnel-ſhaped flower employed by Tournefort. Theſe are the funnel-ſhape properly ſo called, the ſalver-ſhape, and the wheel-ſhape. The reader is not to learn the meaning of theſe terms; they were formerly explained at great length. Tournefort's liliaceous plants are, with equal propriety,

propriety, referred to different claſſes; thoſe which have but one petal arrange themſelves, partly with the bell-ſhaped, partly with the funnel-ſhaped flowers; ſuch only as have more petals than one, are regarded as truly liliaceous, and arranged accordingly. The compound flowers are improperly interjected betwixt the diviſion containing flowers of one petal, and that which comprehends flowers of more petals than one: I ſay improperly, becauſe, in different views, they may be referred, perhaps with equal propriety, to either diviſion. Neither is the term *conglobati*, which he has choſen for characterizing the plants in queſtion, to be preferred to the more general appellation employed by other Botaniſts; for all the compound flowers do not grow in a circular head, as the term juſt mentioned manifeſtly imports. The ſemi-floſcular compound flowers of Tournefort, our author denominates *lingulati*, from the fancied reſemblance of their flat and lengthened florets to a tongue. Trees whoſe flowers grow in catkins, occupy the twentieth claſs, by the name of *filamentoſi*; ſo termed, as I ſuppoſe, from the filaments of the ſtamina which, in many of theſe plants, are long, ſlender like hairs, and with the chaffy ſcales of the calix, are diſperſed along both ſides of a thread-ſhaped receptacle. Tournefort has huddled together, into one claſs, all the trees whoſe flowers are furniſhed with only one petal. Pontedera has parcelled them out into four different claſſes, which acknowledge the ſame principle of diſtribution as herbaceous plants of a ſimilar deſcription. The bell-ſhaped flowers are ſubdivided into four orders; theſe are the bell-ſhaped properly ſo called; tubular flowers; thoſe which are perfectly globular or round; and ſuch as have a ſpreading upper extremity or limb. In arranging his claſſes, Pontedera has adopted a method directly oppoſite to that of Tournefort. The latter

begins with the more perfect plants, and concludes with ſuch as are deficient in ſome of the eſſential parts of fructification. The former, on the other hand, begins with the plants denominated imperfect; and ſo proceeds to ſuch as are more perfect and compleat. Hence petal-wanting flowers are made to precede thoſe in which the petals are preſent; and plants bearing irregular flowers, are, for the ſame reaſon, placed before ſuch as have flowers of a more equal and regular ſtructure. The plan or general delineation only of this method, was publiſhed by our author. Its chief excellence conſiſts in an uniform adherence to the principles with which it ſets out.

AFTER a detail ſo minute as that exhibited in the foregoing ſheets, it is the learner's own fault, if he is not ſufficiently qualified to pronounce with juſtneſs of the merits of every Botanical Method, which, for its diſcriminating character, adopts either the number or figure of the petals. Methods founded upon the calix or flower-cup come next to be reviewed. Of theſe there are only two. The one invented by Peter Magnol, a celebrated profeſſor of Botany at Montpelier, and publiſhed in 1720, five years after the author's death. The other delineated by Linnæus, and publiſhed in his *Claſſes Plantarum*, in 1738, three years after the publication of the Sexual Syſtem. The former is ſingular in its kind, and acknowledges principles of diſtribution, totally different from any that have hitherto been explained. Magnol diſtinguiſhes two kinds of calix; one external, which invelops and ſupports the flower, and is the flower-cup properly ſo called; the other internal, which is the ſeed-veſſel or fruit. According to this idea, all plants, whether herbaceous or woody, are furniſhed with either the external calix only, the internal calix only, or with both.

Hence

Hence the threefold diviſion of the method before us. The firſt diviſion comprehends plants which have the external calix only; that is, are furniſhed with the *perianthium*, or flower-cup properly ſo called, but want the ſeed-veſſel. In the herbaceous department, this diviſion contains ſeven claſſes, and is ſubdivided from the ſituation of the only flower-cover that is preſent; which, in ſome of the plants, involves and includes the flower; in others, ſuſtains and ſupports it. To make this diſtinction intelligible, it will be proper to obſerve, that, in the method under review, the preſence of one or other calix is an indiſpenſible requiſite. Flowers, therefore, which manifeſtly want the *perianthium* or flower-cup properly ſo called, and have no internal calix or ſeed-veſſel, require the uſe of a ſecondary diſtinction, before their place in the arrangement can be determined, or they themſelves be adjudged to belong to any of the three diviſions that have been mentioned. This inconvenience muſt have preſented itſelf to Magnol, upon the very firſt attempt to reduce his method into practice. An author, leſs addicted to novelty than Magnol, would, perhaps, have ſatisfied himſelf with eſtabliſhing a fourth diviſion, expreſſive of the deficiencies alluded to: but it was not the intention of this Botaniſt to do any thing in an uſual way; he loved to ſurprize by the ingenuity and uncommonneſs of his diſtinctions; and was little diſpoſed to make allowances for the capacity of his readers, which could rarely keep pace with the excentricity of his conceptions. The inconvenience complained of, muſt be obviated in a ſingular manner. Upon a ſummary review of the general ſcheme, it appeared to Magnol, that no ambiguity could poſſibly exiſt, ſave in the firſt diviſion; which has, for its diſtinction, the preſence of the external calix only. To the ſecond and third diviſions, he ſeems to think,

think, that the doubtful plants incur no danger of being referred; becauſe, in thoſe plants, the internal calix, which characterizes both diviſions, is manifeſtly wanting. With equal reaſon might I affirm, that the plants in queſtion, being deficient in the *perianthium*, or proper flower-cup, cannot be referred to the firſt diviſion, whoſe characteriſtic diſtinction is the preſence of that organ. But let us ſee in what manner the author incorporates plants, whoſe principles of diſtribution are ſo diametrically oppoſite. I have ſaid, that the firſt diviſion profeſſes to collect flowers which have the external calix only. Now the *perianthium* is the only external calix that I know of. Where, therefore, the *perianthium* is wanting, its place muſt be ſupplied by ſome ſubſtitute, either real or imaginary, before the plants, ſo deficient, can be made to arrange themſelves with thoſe in which the preſence of the external calix is not equally equivocal. A two-fold ſuccedaneum of this kind hath been imagined by Magnol. The *germen*, or ſeed-bud, when placed under the flower in plants of this deſcription, is ſuppoſed to ſerve the office of an external calix; as is likewiſe the blunt extremity of the flower-ſtalk, in plants where the *germen* overtops the flower, or is placed within it. Theſe ſubſtitutes of the external calix are ſaid to ſuſtain and ſupport the flower, in contradiſtinction to the *perianthium*, the only genuine external calix, which invelops and ſurrounds it. The five firſt claſſes of the Magnolian method conſiſt of herbaceous plants, in which the external calix ſurrounds the flower. Under theſe are arranged all the plants whoſe parts of fructification are leſs conſpicuous; ſuch as have the ſtamina, but want the petals; ſeveral flowers of one petal, as comfrey, lung-wort, and the lip flowers; plants whoſe flowers are furniſhed with more petals than one, as thrift, ranunculus, adonis, and drop-wort;

and

and all the compound flowers. The ſixth and ſeventh claſſes are occupied by herbaceous plants, in which the external calix ſupports the flower. Under theſe two claſſes arrange themſelves ſeveral flowers of one petal, as valerian, croſs-wort, wood-roof; and a much greater number that have more petals than one, of which anemone, and the umbelliferous plants, afford proper examples. The ſecond general diviſion conſiſts of herbaceous plants which have the internal calix only. Theſe are contained in a ſingle claſs, the eighth of the method, and correſpond to the liliaceous or bulbous-rooted plants of other Botaniſts. The four ſubſequent claſſes comprehend plants which have both the external and internal calix. Theſe cloſe the firſt branch of the method; and conſiſt either of one petal, as mallow, thorn-apple, and fox-glove; of two or three petals, as enchanter's night-ſhade, and flower-of-a-day; of four petals, as herb-paris, poppy, and the croſs-ſhaped flowers; or of an indeterminate number, as water-lilly, paſſion flower, agrimony, violet, goat's rue, and French honey-ſuckle.

TREES and ſhrubs occupy the three laſt claſſes of the method, and are ſubdivided, like herbaceous vegetables, from the calix. Some trees, as willow, poplar, and fir, have the external calix only; others, as elm, acacia, and vine, have the internal calix only; but the greater number are furniſhed with both.

THE characters of the orders, or ſecondary diviſions, in Magnol's method, are derived chiefly from the figure of the calix, petals and ſeeds; from the diſpoſition of the flowers; from the number of petals, and ſubſtance of the fruit.

FIFTY-FIVE ſections or orders ariſe from the combination of theſe characters with thoſe of the claſſes; and theſe are

again ſubdivided into genera, which, in the method under review, poſſeſs this ſingularity, that, in place of diſtinctive characters, hitherto employed, they exhibit compleat deſcriptions of all the parts of fructification of one or two ſpecies of each genus. From this improvement, for ſuch I conſider it, Linnæus manifeſtly borrowed the hint of his generical deſcriptions.

MAGNOL combats the vulgar opinion that pea-bloom or butterfly-ſhaped flowers have only four irregular petals. He attempts to demonſtrate that all of this tribe are truly furniſhed with five petals; and has in his method arranged them accordingly.

I HAVE nothing farther to obſerve upon this ſingular mode of arrangement. The reader will not fail to conclude from the ſpecimen with which he has been preſented, that facility is not its characteriſtic; and his concluſion will be juſt. It is, in fact, of all others, the moſt difficult in practice; nor do I know that it poſſeſſes a ſingle quality, ſave novelty alone, to recommend it. The obſervations with which it abounds, however ingenious, are frequently whimſical, and calculated to miſlead. The very foundation of Magnol's method is deceptive: for; although it ſets out with the calix, and even profeſſes an uniform adherence to that part of fructification, in characterizing the claſſes; the learner will not have advanced many ſteps, before he finds himſelf bewildered in diſtinctions from the fruit: diſtinctions leaſt of all to be expected, in a method founded profeſſedly upon the calix; yet attempted to be made compatible with the principles of ſuch method, by the operation of an imagined connection and affinity betwixt the calix and fruit.

THERE are many circumſtances which render the calix, under proper reſtrictions, no contemptible foundation of a Botanical method. It is the part of fructification that firſt offers itſelf to our ſenſes. It's uſes are important. It preſerves the flower from external injuries, and even extends its care to the fruit, which, after the fall of the flower, it frequently accompanies to maturity. In point of ſtructure, the calix is exceedingly diverſified. The term is general, and comprehends under it ſeveral different ſpecies. Varieties equally conſpicuous are exhibited, by this organ, in point of number and figure. Its ſituation too, with reſpect to the ovary, or ſeed-bud, is different in different plants: as is likewiſe its permanency or duration. Of all or moſt of theſe circumſtances has Linnæus availed himſelf, in the conſtruction of his *Method founded upon the Calix*, which, in the idea and execution, is greatly ſuperior to that of Magnol; and is indeed ſingularly uſeful, in familiarizing to the novice in Botany, the various appearances of an organ ſo important in its nature, and ſo diverſified in form. The method in queſtion ſets out with enumerating the different ſpecies of calix. Theſe are adjudged to be ſix in number: *ſpatha*, *gluma*, *amentum*, *involucrum*, *calyptra*, and *perianthium*. ---Of theſe in order.---

SPATHA, a ſheath, is a ſpecies of calix which, burſting lengthways from bottom to top, protrudes a ſtalk with one or more flowers, that generally want the *perianthium*, or proper flower-cup. It is of a membranous ſubſtance, adheres to the ſtem, and is commonly of one piece, which admits of great variety in point of figure. Narciſſus, ſnow-drop, arum, and the tribe of palms, afford examples of the ſpecies of calix alluded to.---The ſtalk protruded from a *ſpatha* has obtained, among

Botaniſts, the name of *ſpadix*; a term formerly reſtricted to the flowering branch protruded from the *ſpatha* of palm-trees; but extended, by Linnæus, to all plants, whether herbs or trees, which exhibit a ſimilar appearance.

GLUMA, the huſky calix of the graſſes. It is compoſed of one, two, or three ſcales, termed *valves*, generally tranſparent at the edges, and moſt frequently terminated by a rough pointed thread, called the *ariſta* or beard.

AMENTUM, catkin. The reader will find this term ſufficiently explained in the analyſis lately given of the Tournefortian method: where he will likewiſe meet with an ample deſcription of the next term

INVOLUCRUM, a cover or wrapper: the calix of the umbelliferous plants. It deſerves to be remarked, that, in the method now under review, all plants, whoſe flowers grow in an umbel, are arranged under one claſs, whether the *involucrum* be preſent or wanting. Linnæus reckons it ſufficient to have marked the place where ſuch *involucrum* would have been ſtationed, had it been preſent in the plant.

CALYPTRA, a veil or covering: the calix of the moſſes. It reſembles an extinguiſher, and is ſuſpended over the antheræ or ſummits.

PERIANTHIUM, the flower-cup properly ſo called. It ſurrounds the flower, or is placed immediately under it.

THE four kinds of calix firſt mentioned give riſe to as many claſſes in the method before us. Plants, whoſe flowers are

furniſhed with the fifth kind of calix, are transferred, on account of the ſmallneſs of their number, to a ſort of miſcellaneous claſs, the laſt of the method; whoſe characteriſtic diſtinction is the abſence of every ſpecies of flower-cup that ſerved to diſcriminate the other claſſes. The diverſities of the *perianthium*, or proper flower-cup, are next employed for diſtinguiſhing the thirteen claſſes that remain. The order of their arrangement is as follows. Of plants that are furniſhed with the *perianthium*, ſome have it common to many flowers; others have each flower ſurrounded or involved by a flower-cup that is proper and peculiar to itſelf. The former are the compound flowers, and occupy a ſingle claſs, the fifth in the method, by the general name of *Communes*; that is, flowers contained within a common calix. Of plants which have a flower-cup ſupporting a ſingle flower, ſome are furniſhed with a double *perianthium*, as the mallow tribe, which conſtitute the ſixth claſs; but the greater number have the flower-cup ſingle, as well as the flower. To diſcriminate the numerous plants which arrange themſelves under this laſt diviſion, the author has recourſe to the ſituation of the calix, and its relation to the flower. In many plants, the ſtamina and petals are attached internally to the ſides of the flower-cup. Such are herb-bennet, roſe, cinquefoil, and many of our choiceſt fruit-trees; particularly apple, peach, plumb, cherry and pomegranate. To theſe, and others of a ſimilar deſcription, is allotted the ſeventh claſs of the method under review, which has obtained the name of *Floribundi*, from its diſtinctive character, the production of the flower from the internal ſides of the flower-cup. The eighth claſs is occupied by plants in which the *perianthium* ſurmounts the ſeed-bud, or is ſtationed upon the top of it, in form of a crown. It is exemplified in

marvel of Peru, valerian, cucumber, and honey-ſuckle. The nine remaining claſſes conſiſt of plants in which the flower-cup embraces or ſurrounds the ſeed-bud. Theſe are primarily ſubdivided from the uniformity of the *perianthium* with the flower, or from the oppoſite quality. In the ninth claſs, the flower-cup is of a different figure from the petals. In the tenth, a diverſity of form obtains betwixt the different flower-cups of the ſame ſpecies. Fumatory, balſam, poppy, pæony, and water-lilly, afford proper examples of the former. Croſs-wort, box, nettle, hemp, palma-chriſti, mulberry, and ſome other plants, which have the ſtamina and ſeeds placed apart on the ſame or different roots, ſerve ſufficiently to exemplify the latter. Of plants, whoſe *perianthium* differs not in form from the *corolla*, ſome drop the flower-cup, either at the unfolding or falling off of the flower; others retain it, either entire or withered, until the fruit has attained maturity. Thoſe with a deciduous calix conſtitute the eleventh claſs, which is exemplified in thorn-apple, adonis, barren-wort, and the croſs-ſhaped flowers of Tournefort. The four ſubſequent claſſes are occupied by plants whoſe flowers are furniſhed with a permanent calix. Theſe ſtand primarily diſtinguiſhed from the diviſions of the flower-cup, which, in ſome, are equal and regular; in others, unequal and irregular. Of flowers with a permanent and regular calix, ſome have only one petal, as jeſſamy, lilac, privet, borrage, periwinkle, and oleander; others have more petals than one, as flowering-ruſh, rue, paſſion-flower, ſea-pink, lychnis, and ſaxifrage. To the plants juſt mentioned, and thoſe of a ſimilar deſcription, are the twelfth and thirteenth claſſes of the preſent method aſſigned. Plants having a permanent calix that is irregular, are contained in the two next claſſes, which ſtand diſtinguiſhed, like the former,

former, from the number of petals of which the flower conſiſts. In the fourteenth claſs, the flower-cup is permanent, irregular, and ſupports a ſingle petal. It is exemplified in the *lip-flowers* of Tournefort, and *thoſe which reſemble the ſnout of ſome animal*, of the ſame author. In the fifteenth claſs, the flower-cup is permanent, irregular, and ſupports more petals than one. Fraxinella, violet, horſe-cheſnut, and the pea-bloom or butterfly-ſhaped flowers, furniſh proper examples.

THE ſixteenth and ſeventeenth claſſes, the only two that remain to be diſtinguiſhed, conſiſt of plants in which one only of the external covers of the flower is preſent. In flowers of the former claſs, the cover in queſtion, whether calix or *corolla*, falls off either at the opening of the flower, or when flowering is accompliſhed. In thoſe of the latter, it remains attached to the fruit, which it accompanies to perfect maturity. Meadow-rue, monkſhood, lark-ſpur, marſh marigold, and the liliaceous plants, afford examples of the one: blite, mercury, mulberry, and white hellebore, of the other.

SECTION

SECTION VI.

Analyſis and examination of the Sexual Syſtem.

THE Hiſtory of Botany and Botanical methods cloſes with a review of the much-celebrated Sexual Syſtem of Linnæus. The reader enters upon its examination with conſiderable advantages. He is well inſtructed in the nature of Botanical arrangement. He has attentively peruſed, and carefully digeſted, each of the numerous plans which make the ſubject of the preceding part of this prefatory VIEW. He has formed a proper eſtimate of their merits and defects. He has acquired an intimate knowledge of the ſeveral parts of plants upon which the methods in queſtion have been founded. He has been repeatedly taught, and muſt have been repeatedly convinced, that the chief excellence of every nomenclature conſiſts in its facility. That excellence he has ſeen attained in a ſuperlative degree, by none: in an inferior degree, by few. It remains, that we give him an opportunity to judge, whether Linnæus, the greateſt naturaliſt of this, or, perhaps, any age, has proved that ſtandard of perfection attainable; and thus deſervedly ſnatched the palm from the crowd of his diſtinguiſhed and illuſtrious predeceſſors.

THE method now before us, is founded upon the number, proportion, ſituation and union of the ſtamina, chives, or ſlender threads of the flower: a part of fructification with which my readers will ſoon be familiar. The principle with which it ſets out

out is expreſſed in the title. It proceeds upon a fancied analogy betwixt the ſeveral parts of plants and thoſe of animals; and ſuppoſes the exiſtence and concourſe of the ſexes to be as indiſputably aſcertained in the former, as in the latter. This exiſtence, and that concourſe, muſt be previouſly eſtabliſhed. Without proper lights upon this curious and important ſubject, the ſyſtem itſelf, which throughout employs terms expreſſive of the analogy in queſtion, would be abſolutely unintelligible.

We have ſeen, in the courſe of the preceding ſections, that the flower and fruit are formed of a numerous combination of organs: we now lay it down as an axiom, which admits not of diſpute, that theſe organs are indubitably deſtined for the formation of the ſeeds, which ſerve to multiply the ſpecies. In this general deſtination, all naturaliſts are agreed. But their ſentiments have been very divided, with reſpect to the different functions to be attributed to each particular organ.

Complete flowers are formed of the calix or flower-cup, the petals, the ſtamina, and one or more piſtils. All theſe parts, however, are not equally eſſential. The calix cannot be regarded as indiſpenſibly neceſſary to fructification; becauſe many flowers, which manifeſtly want the calix, produce, notwithſtanding that defect, ſeeds that are ripe, well-formed, and capable of vegetation. For the ſame reaſon, the petals have been denied a place among the eſſential organs of fructification; although their functions, as well as thoſe of the calix, are undoubtedly of conſiderable importance in the œconomy of plants. The former, being the leaves of the flower, ſerve to protect the ſtamina and piſtils; perform the office of organs of ſecretion; and are, probably, uſeful in elaborating the juices which

which reſide in the more eſſential parts of fructification. The latter defends the infant-organs from the inclemencies of the weather; and ſupplies with nouriſhment the parts attached to it.

FROM what has been ſaid, it is evident, that the organs indiſpenſibly neceſſary to fructification, are reduced to two; the ſtamina and piſtils: and that both are entitled to this deſcription, a variety of obſervations do ſufficiently evince. Theſe obſervations eſtabliſh,

1. THAT there is no plant capable of furniſhing good, well-conditioned ſeeds, that is not provided with ſtamina and piſtil: and thoſe either produced within the ſame covers; or ſeparated from each other, upon the ſame plant, or upon different plants raiſed from the ſame ſeed.

2. THAT flowers which poſſeſs the higheſt degree of luxuriance, and have all the ſtamina metamorphoſed into petals, produce no perfect ſeeds.

3. THAT ſeeds equally barren and imperfect, are furniſhed by ſuch flowers as have their piſtil transformed into ſlender expanſions, reſembling leaves.

4. THAT, if the ſtamina of any plant are cut off before the *antheræ* or ſummits have diſperſed the powder incloſed within their ſubſtance, the fruit is productive of imperfect ſeeds.

5. THAT a ſimilar abortion takes place, when, upon the expanſion of the flower, the ſtyle or ſtigma is cut off; when the moiſture which covers that organ is totally abſorbed by

continued

continued ſmoke, or carried off by perpetual ſhowers; when the tops of the ſtamina are hindered from opening by ſudden froſts, or their powder diluted and waſhed away by violent rains.

THESE facts, which are eſtabliſhed beyond the poſſibility of a doubt, prove only that the ſtamina and piſtils are abſolutely neceſſary towards the formation of the ſeeds; but are not deciſive with reſpect either to the uſe of thoſe parts, or to the manner in which that formation is accompliſhed. Some naturaliſts, and Tournefort is of the number, have regarded the ſtamina and piſtils as organs of ſecretion, whoſe ſole function conſiſts in relieving plants from the leſs uſeful parts of the nutritive juices, in nearly the ſame manner as the reins of animals ſeparate the urine from the maſs of their blood. Others, as Pontedera, have pretended that theſe *viſcera* are compoſed of a number of *utriculi* or ſmall bladders, in which the ſap, being highly elaborated by a proceſs not to be explained, is rendered proper for nouriſhing the young and tender fruits. Dr. Alſton agrees with Tournefort in regarding the *pollen* or powder of the *antheræ* as a ſimple ſecretion; he even ſcruples not to declare, that, as buds, which have attained a higher ſtage of vegetation than ſeeds, are confeſſedly produced by numberleſs plants, without the aſſiſtance of the duſt of the ſtamina, he ſees no reaſon why ſeeds, which he denominates a more imperfect kind of buds, may not, *à fortiori*, be likewiſe produced without that aſſiſtance. The opinion, however, that is now almoſt univerſally received, attributes the fecundation of the ſeeds to the agency of the *pollen*, which diſperſing itſelf upon the *ſtigma* or ſummit of the piſtil, and burſting in the moiſture that is lodged on its ſurface, is ſuppoſed to tranſmit either its ſubſtance or ſome vivyfying

effluvia to the ovary below for the purpoſe of impregnation. This opinion is founded, firſt, upon the analogy that has been obſerved to obtain between plants and animals: ſecondly, upon the ſucceſs of ſeveral experiments, which uniformly tend to prove, that, when the communication between the ſexual parts of plants has been either accidentally or induſtriouſly intercepted, the ſeeds have always proved barren, and incapable of vegetation.

CUSTOM has eſtabliſhed an errroneous diſtinction of plants into male and female, which well deſerves to be exploded. This diſtinction is not founded upon any organical diſpoſition reſpecting the ſexes; but upon the differences of port and habit. Female plants, in the language of this diſtinction, are ſuch as have a weaker and more delicate texture, or are of ſmaller ſize. Male plants, on the contrary, are larger and more robuſt.

UNPHILOSOPHICAL as is this mode of diſcriminating the ſexes, it wants not the ſanction of the moſt remote antiquity to plead in its favour. Theophraſtus, Ariſtotle, and Dioſcorides, have ſucceſſively entertained miſtaken notions upon this ſubject. The firſt-mentioned naturaliſt denominates certain trees male and female, which, according to the modern and more philoſophical doctrine of the ſexes, are indiſputably hermaphrodite; that is, have both organs of generation contiguous, and incloſed within the ſame calix and petals: and in thoſe claſſes, whoſe individuals are truly male and female; that is, bear the ſtamina and piſtil on different roots produced from the ſame ſeed, he eſtabliſhes that diſtinction, not from the ſuppoſed or demonſtrated exiſtence of the ſexes, as we might naturally be led to imagine, but from the vigour, ſize and ſtrength of the trees. Dioſcorides and Ariſtotle have been equally inaccurate and erroneous.

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The former, diſtinguiſhes the greater part of plants into male and female; but eſtabliſhes no ſcientific foundation of ſuch diſtinction. He even frequently proceeds in direct oppoſition to analogy. Thus his female mercury is barren; the male fruitful. Ariſtotle's marks of diſtinction are not more ſatisfactory. The male plant, according to that author, is larger, more rigid, abounds leſs in moiſture, is ſtronger, more branchy, and ſooner attains maturity. The female is weaker, but more fruitful, leſs branchy, more abundant in juices, and more tardy in reaching maturity. Pliny, Galen, Johnſton, and ſome other writers, have adopted the ſame erroneous diſtinctions.

We are not, however, to imagine, from what has been ſaid, that the antients were totally ignorant of the ſexual difference in plants. It appears, on the contrary, from ſeveral paſſages in their works, that, in a few inſtances, they perfectly underſtood that difference, and attributed the fecundation of the fruit to the agency of the *pollen* or powder of the ſtamina. The obſervations of the antients reſpecting the ſexes ſeem to have been reſtricted to palm-trees; the only plants which are characterized male and female, from ſcientific analogy. Theophraſtus, ſpeaking of the curious huſbandry of palm-trees, ſays expreſly, that the fruit of the female tree never ripens, unleſs the downy duſt which reſides in the flower of the male palm is ſhaken over it. He adds, that, on this occaſion, there is manifeſtly a coition or intercourſe of the ſexes. To the ſame purpoſe is Ariſtotle's obſervation; that when the duſt of the male palm is carried along by the wind, and ſhed upon the female, the fruits of the latter ripen apace; juſt as, in the former caſe, when a branch of the male was ſhaken or ſuſpended over it. Pliny calls the female palms, deprived of the male duſt, barren

widows. He compares the conjunction of theſe plants to that of animals; and obſerves, in general, that the fruit of the female always proves abortive, unleſs impregnated with the duſt or down of the male.

ZALUZIANSKI and Cæſalpinus are the firſt of the moderns who have treated with accuracy of the ſex of plants. The latter attributes the fecundation of the fruit, in plants which have the ſtamina and piſtil on diſtinct roots, to the *pollen* or powder of the *antheræ*. He denominates thoſe plants, whether herbs or trees, male, which produce the ſtamina only, and are conſequently barren: thoſe which produce the fruit only, and are impregnated by a male individual of the ſame ſpecies, he denominates female. He adds, that the fruits ſucceed better, when the plants which bear them are in the neighbourhood of the male.

DR. Grew, in his Anatomy of Plants, has carried his reſearches ſtill farther. The obſervations which that ingenious naturaliſt communicated to the Royal Society, on the impregnating duſt of the ſtamina, tend to demonſtrate, that all plants are furniſhed with the organs of generation; as well thoſe in which the ſtamina and piſtil are incloſed within the ſame covers, or ſeparated from each other upon the ſame root, as thoſe which have the organs in queſtion produced upon diſtinct roots. Grew poſitively affirms, upon the evidence of ſeveral microſcopical experiments, that when the ſummits of the ſtamina open, the duſt or powder which they contain falls down upon the piſtil, and fecundates the ſeed-bud; not by paſſing bodily through the ſtile into the ovary, but by the communication of a ſubtile and vivifying exhalation. This opinion of Grew was adopted by Mr. Ray, in the Preface to his Hiſtory of Plants.

CAMERARIUS, a celebrated Botaniſt of the laſt century, and author of a curious Diſſertation on the Analogy betwixt the Generation of Plants and Animals, obſerved, that, upon plucking off the ſtamina and piſtils of ſome male and female plants, particularly maiz and mulberry, the buds that ought to have produced fruit, came not to maturity; or, if they appeared to ripen, produced ſeeds incapable of vegetation.

MR. Samuel Morland, in his papers upon this ſubject, to be found in the Philoſophical Tranſactions, agrees with Dr. Grew, that the ſeeds are univerſally fecundated by the *pollen*, or duſt of the *antheræ*; but will not allow, with that author, that the fecundation in queſtion is accompliſhed by means of any vapour or ſpirituous emanation. He pretends, that the duſt of the ſummits of the ſtamina is compoſed of a maſs of ſeminal plants, which paſs bodily through the piſtil into the ovary, and introduce themſelves ſingly into every ſeed.

M. GEOFFROY, author of a Diſſertation on the Uſe of the principal Parts of Flowers, to be found in the Memoirs of the French Academy of Sciences for 1711, aſſerts, from obſervation ---1. That the germ is never to be perceived in ſeeds, till after the ſummits of the ſtamina have ſhed their duſt---2. That when the ſtamina are cut off before the exploſion of their duſt, the ſeeds prove abortive, or remain barren. Maiz and mercury, the inſtances adduced by Camerarius, are employed by Geoffroy in exemplifying the latter of theſe obſervations. Camerarius, however, it deſerves to be remarked, acknowledges, that in his experiments upon the plants juſt mentioned, ſome of the ſeeds arrived at perfect maturity, ſo as to be capable of vegetation. This partial fecundation the author not improperly attributes to the

the agency of ſome of the fertilizing duſt, which had probably been tranſported by the winds from a conſiderable diſtance, and diſperſed itſelf upon the female plant.

M. VAILLANT, another ingenious French Academician, is a ſtrenuous advocate for the ſex of plants. His obſervations upon that ſubject are communicated in a Diſſertation upon the Structure of Flowers, firſt publiſhed in 1718. Vaillant remarks---1. That in pellitory, the ſtamina have frequently ſhed their duſt, before the piſtil is opened---2. That the duſt cannot reach the ſeed-bud through the piſtil, which is often not hollow ---3. That when the piſtil is apparently hollow, no opening can be perceived, through which the duſt can inſinuate itſelf into the ſeeds---4. That a volatile and ſubtile ſpirit, tranſmitted by the male duſt, may be communicated from the piſtil to the umbilical veſſels, and by that means arrive at the ſeed. Hence it appears, that Vaillant adopts Grew's opinion with reſpect to the manner of fecundation, in oppoſition to that of Morland and Geoffroy.

BEFORE we proceed farther, it will be proper that we preſent the reader with ſome general obſervations, reſpecting the analogy that obtains betwixt the generation of plants and animals.

THE antients admitted two ſorts of generation---One, which was the reſult of putrefaction;---and to this the greater part of inſects were believed to owe their origin. The other reſults from the concourſe of the two ſexes;---a concourſe which, in the larger animals, was too obvious to admit of diſpute.

THE abſurd doctrine of equivocal generation, thanks to the ingenuity of the moderns, is now univerſally exploded. The

invention of glaſſes has much enlarged the obſervations of the naturaliſt, and, in ſome ſort, opened a new world to his view. In the animal kingdom, we have been enabled, by means of microſcopes, to penetrate into the moſt hidden arcana of nature, and to witneſs the reproduction of numerous inſects, which were erroneouſly believed to draw their origin from putrefaction, In the vegetable kingdom, the induſtry of Botaniſts, aſſiſted by the uſeful inſtruments juſt mentioned, has overcome obſtacles formerly deemed inſurmountable, and rendered the analogy betwixt plants and animals compleat, by demonſtrating the exiſtence of ſeeds in ſeveral vegetables, which were vulgarly thought to want them, and thus inducing a probability of their exiſtence in all. True it is, that we have not yet been able, by glaſſes, to obſerve the mode of generation of thoſe very minute bodies, which being totally imperceptible by our groſſer optics, were not even ſuſpected to exiſt, till the microſcope aſtoniſhed us with a glimpſe of them, and called them forth into life. But ſince, upon innumerable occaſions, we have witneſſed the actual conjunction of very ſmall inſects; ſince we have diſcovered the induſtry and foreſight which all of this tribe exhibit in depoſiting their eggs; how ſome repair to the ſhambles in queſt of a proper *nidus* for their young; how others, from the ſame motive, penetrate even into the bodies of animals; how ſome inſects pierce the hides of oxen; how others make their way, through the bark, into the wood of trees: and all with an intention of lodging the worms, which are to iſſue from their eggs, in a place that is likely to afford them nouriſhment ſuitable to their nature; ſince theſe facts have been indubitably eſtabliſhed, by the joint reſearches of Redi, Reaumur, Micheli, Linnæus, and other celebrated naturaliſts, are we not engaged to believe that the uniformity of Nature is never

never diſturbed; not even in thoſe beings where the mode of generation, by reaſon of their extreme minuteneſs, cannot be rendered viſible? Not that we are to pronounce, with certainty, of their orign. Future diſcoveries may perhaps juſtify the moſt poſitive affirmations of this kind. At preſent, ſuch an aſſertion were raſh and unphiloſophical. Thus far, however, we may ſafely and rationally conclude; that when, as in the preſent caſe, obſervation proves defective, and the origin of certain inſects, or certain moſſes, eludes our utmoſt avidity of reſearch, we do no material violence to Nature, by ſuppoſing them to be generated like other beings of the ſame kind, with which obſervation hath made us acquainted, and whoſe origin was formerly unknown. From the general law of Nature there can be no conſiderable deviations; no being owes its formation to chance; and all are probably produced by a ſimilar mode of generation, depending on the concourſe of the two ſexes; the minuteſt inſect, as well as the elephant; the ſmalleſt moſs, as well as the moſt ſtately and elevated oak.

THESE obſervations are ſufficient to diſprove the abſurd doctrine of equivocal generations, which, to the reproach of ſcience, were long univerſally believed. And certainly he who invariably ſubmits his ideas to experience, and is careful that his reaſonings quadrate with obſervation, will beware of advancing, that a body, which he ſees organized with ſuch art, with ſuch evident marks of wiſdom and deſign, is the reſult of chance, is the product of a confuſed motion, of a blind and fortuitous arrangement of the parts of matter. If any one was whimſical enough to attempt to renew theſe antient and deſervedly-exploded opinions, I would aſk him, how ſuch opinions could poſſibly be made to ſquare with the uniformity

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that is ſo generally obſerved to obtain betwixt all the productions of nature? The variations exhibited by the different ſpecies of plants and animals, are, indeed, wonderfully numerous. But, though numerous, they are not conſiderable. A ſucceſſion of ages has not been able to produce any remarkable deviation in the ſpecies from its original: and we may venture to aſſert, that plants and animals may perpetuate themſelves to infinity, without undergoing any conſiderable change. From the remoteſt times, elephants have always produced elephants; gnats have produced gnats; from oaks have ſprung other oaks; moſſes have given birth to moſſes.

NATURE ſeldom relinquiſhes the general laws which have been originally impoſed upon it by its Divine Author. Hence we conclude by analogy, that, as a number of beings endued with life confeſſedly proceed from eggs, plants which are organized bodies, and poſſeſs a ſpecies of life, ought to have an origin ſomewhat ſimilar. Not that the mode of propagation in plants is equally confined as in animals. Vegetables perpetuate the ſpecies not by the ſeeds only, but likewiſe by buds, by ſuckers, frequently by the leaves, by layers, by grafting. Yet of theſe various kinds of propagation, the firſt is certainly moſt eſſential to plants, and that which is moſt conſentaneous to their nature. For if we trace buds, ſuckers and layers to their origin, we ſhall find that they have been produced by plants, which have at firſt owed their formation to a ſeed or vegetable egg. By comparing the ſeeds of plants to the eggs of animals, I do not pretend to eſtabliſh that the organization of the former is in any degree ſimilar to that of the latter. Certain it is, however, that both eggs and ſeeds are produced for the ſame end: I might even aſſert, that there is more reſemblance

betwixt the ſtone of a fruit and a bird's egg, than betwixt this latter and the egg of a viviparous animal.

A HEN can lay eggs without the aſſiſtance of the cock; but thoſe eggs, being void of the germ or *punctum vitæ*, cannot produce chickens, are incapable of animation. Obſervation eſtabliſhes that the eggs of the female of every animal are equally unfruitful without the aid of the male; and hence the concourſe of the two ſexes has been conſidered as the general law of animal nature, and as abſolutely neceſſary towards the multiplication of the ſpecies. We ſhall ſee in the ſequel that the ſame law may be extended to vegetables; and that the fruits and ſeeds of plants no leſs certainly than the eggs of birds may attain their proper and natural ſize without the agency of fecundation.

THAT the fecundation of plants is operated in a different manner from that of animals ought not to appear ſingular, ſince even in the different ſpecies of animals, that operation is differently accompliſhed. Neither ſhould our uncertainty of the manner in which the fecundation of ſome plants is operated be alledged as an objection againſt the doctrine of the ſexes in general, or their exiſtence in the plants alluded to, in particular. The difference of ſex in fiſhes is well aſcertained; and there is no ground whatever to ſuſpect, that their eggs are not fecundated: yet can we not explain in a ſatisfactory manner how that fecundation is accompliſhed. The ſame imperfection attends our moſt elaborate endeavours to explain the manner in which the fecundating ſubſtance acts upon the eggs of animals. Upon this ſubject, a variety of ſyſtems have been ſucceſſively imagined; much reaſoning has been expended: but as the internal

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action which they meant to explain did not admit of experiments or obſervation, obſcurity has ever prevailed. Accordingly, the fact is certain, but the manner of its accompliſhment ſtill remains unknown.

To the fermentations and precipitations of the antients ſucceeded, among others, two hypotheſes, which appeared more worthy of attention. Harvey was of opinion that each ovum contained the embryo or rudiments of an entire animal, which was called forth into life and motion by the ſecret and inexplicable agency of the male. The followers of that celebrated author, finding it difficult to conceive, that a machine ſo admirable as the body of an animal ſhould be formed by another animal, have maintained that all the germs were originally formed at the firſt creation of the ſpecies. That matter is diviſible *ad infinitum*, is geometrically demonſtrable: yet is it ſcarce poſſible to conceive that the germs of all the numerous ſucceſſions of any ſpecies of animal were bodily contained in the ovary of that individual which firſt iſſued from the hands of the Creator.

Lewenhoeck having perceived, by the aſſiſtance of the microſcope, a number of moving, and apparently animated, bodies in the ſeminal liquor, concluded from thence, that, in conſequence of coition, each of thoſe *animalculæ*, which he regarded as a particular ſpecies of worms, lodged itſelf in the egg, as in a proper *nidus*, there increaſed in volume, was metamorphoſed in the manner of inſects, and became at length an animal ſimilar to that from which it had been produced. This opinion, however ingenious, is liable to conſiderable objections.

1. If, according to Lewenhoeck, the ſeminal worms are metamorphoſed in the eggs, the young animals ought undoubtedly, at the moment of their birth, to be covered with the ſpoils of their former ſtate. No ſuch appearance, however, can be obſerved. A chicken is contained in the folds or covers of the egg, and has no covers that are proper and peculiar to itſelf.

2. As the ſeminal worms in queſtion proceed ſolely from the male, the offspring ought always to reſemble the father. Experience teaches us that they no leſs frequently reſemble the mother. A greyhound and ſpaniel bitch produce mongrels which reſemble both.

3. What is the origin of theſe pretended worms? Shall it be ſaid, that they are produced by other worms, thoſe ſtill by others, and ſo *ad infinitum?* This ſuppoſition is highly improbable, and, if admitted, does not explain the manner in which generation is accompliſhed. The difficulty ſtill remains, being only transferred from the larger animals to the ſeminal worms, to which thoſe animals are ſuppoſed to owe their origin.

Lastly, ſome pretend that the ſmall bodies which Lewenhoeck obſerved, are not real living animals, but only organical parts, which, by their aggregation, can form organized bodies. This new opinion, far from throwing light upon a ſubject of all others the moſt obſcure, ſerves to plunge us into thicker and more impenetrable darkneſs. I ſpare the reader a thouſand reveries to which the queſtion reſpecting generation has given riſe. The little which I have here related is ſufficient to ſhow what wild chimeras the human mind is apt to entertain, when it would riſe to inacceſſible objects, or purſue devious tracks unknown to obſervation and experience.

THE ſeeds of plants are true vegetable eggs; as ſuch, they require to be fecundated, before they can be capable of producing a plant ſimilar to the parent-plant. Vegetables then have neceſſarily the organs of the two ſexes: but what are theſe organs, and where do they reſide?

IT is evident that we muſt ſeek for the organs of generation of plants in the parts where the ſeeds are formed, where they receive fecundation, and where they take their growth. Thoſe parts are the flowers and fruit; which are therefore very properly defined by Linnæus, the organs of generation of plants which ſerve, the former, for the fecundation of the ſeeds, the latter, for the nouriſhment of the fœtus. Now all plants which bear ſeeds have ſtamina and piſtils. The ſtamina are the male parts, the piſtils the female. When the ſtamina and piſtils are found collected in the ſame fructification, as happens in the greater number of plants, the flower is termed *hermaphrodite*. When the fructification contains ſtamina only, the flower is termed *male*; when piſtils only, *female*. Male and female flowers are ſometimes produced upon different parts of the ſame individual plant; ſometimes upon different individuals ſprung from the ſame ſeed. The plants, in the former caſe, are termed *androgynous*; in the latter, *male* and *female*. This ſeparation and this union of the ſexual organs of plants offers nothing contrary to what is obſerved in animals: for although the greater part of theſe laſt poſſeſs individually but one ſex, there are ſome, particularly the earth-worm and ſnail, which, like hermaphrodite or androgynous plants, have both organs united in the ſame individual.

OBSERVATION eſtabliſhes that the *antheræ* or ſummits of the ſtamina, whilſt they ſerve as a reſervoir for containing the fecun-

dating matter, perform, at the ſame time, the functions of organs which miniſter immediately to its ſecretion and preparation. Thoſe ſummits, in progreſs of vegetation, open; the duſt which they incloſe within their ſubſtance is diſperſed upon every ſide; and fecundation is thus accompliſhed.

I DO not pretend poſitively to affirm that it is this duſt or powder which actually impregnates the ſeeds; perhaps it is the fine and almoſt imperceptible grains which the microſcope diſcovers in the liquor, after the burſting of the ſmall bladders of which the powder in queſtion is formed; perhaps it is the liquor itſelf which operates the fecundation; perhaps, even, it is the ſpiritous exhalation, which produces that effect. Of the deſtination of objects which elude our reſearch we cannot pronounce with certainty or preciſion.

SUCH is the hypotheſis of the exiſtence of the ſexes in plants, and of their concourſe for the purpoſe of impregnating the ſeeds. It ſeems ſtrictly conformable to the general laws of Nature, and is ſupported by a variety of proofs, ſome of which have been already related.

PALMS are of the number of thoſe trees which bear male and female flowers upon different individuals. Herodotus relates that in the eaſtern countries, where they make great uſe of the fruit of the palm-tree, the peaſants faſten branches of the male palms upon the branches of thoſe which bear the fruit: and even in the time of Alexander, the inhabitants of the country, who cultivated palm-trees, had perceived that it was of importance to the fructification that the male and female palms were found in the neighbourhood of each other. The

fact

fact related by Herodotus is confirmed by the more recent obſervations of Tournefort, Haſſelquiſt, and other Botaniſts; yet did not appear ſufficiently concluſive to produce any alteration in the opinion of the firſt-mentioned naturaliſt, who uniformly denied the exiſtence of the two ſexes in vegetables.

PROSPER ALPINUS affirms, that the large crops of dates which the Deſerts of Arabia produce, depend not upon any particular mode of culture, but are occaſioned by the powder or downy duſt of the ſtamina which the wind tranſports from the male flowers of the date-tree upon the female.

IN ſhort, Theophraſtus, Pliny, Proſper Alpinus, Tournefort, Haſſelquiſt, and Kempfer, unanimouſly think, that, without the aſſiſtance of the male flowers, not only the dates would be greatly inferior in point of richneſs and taſte, but the ſtones, like eggs which wanting the germ, cannot be hatched, would be found abſolutely incapable of vegetation.

FATHER LABAT relates, in his Voyage to America, that he ſaw near a convent of his order at Martinico a female palm-tree which produced fruit though planted at the diſtance of ſome leagues from all thoſe of its ſpecies. This fact, however, contains nothing contrary to the opinion of the authors already quoted, becauſe the reverend father immediately ſubjoins that the ſtones of the date-tree in queſtion did not riſe, and that its fruits were not ſo luſcious and well-taſted as thoſe of Barbary and the Levant.

J. BAUHIN aſſerts that a very old palm-tree which he ſaw at Montpelier had not begun to produce fruit till the age of fifty

or

or ſixty years; but he does not mention whether the fruits were well-conditioned, or if the ſtones were found capable of vegetation.

GEOFFROY, in his Materia Medica relates, that, in Sicily, the flowers of the male piſtachio-tree are ſuſpended over the branches of the female, with a view of impregnating the fruit.

M. PEYSSONNEL, French conſul at Smyrna, and M. Couſineri, chancellor at Chio, affirm, that in the Levant, turpentine and maſtich-trees are diſtinguiſhed into male and female, from the abſence or preſence of the fruit, and ſuppoſed fertilizing quality of the duſt of the ſtamina Couſineri adds, however, that he has found a kind of maſtich-tree, which carried both male and female flowers upon the ſame individual.

M. DUHAMEL DU MONCEAU, of whoſe very ingenious obſervations upon this ſubject, I have frequently availed myſelf in the courſe of this ſection, relates an experiment performed by himſelf and M. Bernard de Juſſieu, a celebrated French academician, which bids fair to be deciſive upon the queſtion of the ſexes. In the garden of M. de la Serre of the Rue S. Jacques at Paris, was a female turpentine-tree, which flowered every year, without furniſhing any fruit capable of vegetation. This was a ſenſible mortification to the owner, who greatly deſired to have the tree increaſed. Meſſieurs Duhamel and Juſſieu very properly judged that they might procure him that pleaſure by the aſſiſtance of a male piſtachio-tree. They ſent him one very much loaded with flowers. It was planted in the garden of M. de la Serre very near the female turpentine-tree, which the ſame year produced a great quantity of fruits, that

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were well-conditioned, and roſe with facility. The male plant was then removed; the conſequence of which was, that the turpentine-tree of M. de la Serre in none of the ſucceeding years bore any fruit, that, upon examination, was found to germinate.

The author juſt-mentioned relates that he has in his poſſeſſion a vine-branch which flowers every year, but produces no fruit, owing, as he ſuppoſes, to the deficiency of piſtils. A quantity of ſtrawberries, in the garden of the ſame ingenious Botaniſt, prove annually barren, becauſe the flowers are totally devoid of ſtamina.

By the report of ſeveral naturaliſts, a ſolitary plant of female hemp, ſpinnage or mercury produces very few ſeeds that are capable of vegetation. Thoſe who admit not the diſtinction we would eſtabliſh, affirm, that even this ſmall quantity of well-conditioned ſeeds is ſufficient to prove that the concourſe of the two ſexes is not abſolutely neceſſary; but if a ſingle plant of female hemp that is ſurrounded by male plants, affords numerous perfect ſeeds; and if a ſimilar female plant, which is deprived of that aſſiſtance, produces only a few, ought we not to conclude, that the emanations of the male plants have an influence in impregnating the female? And may we not be juſtified in aſſerting, that the female flowers of the ſolitary plant juſt mentioned were fecundated either by a male plant of the ſame ſpecies, whoſe fertilizing duſt had been tranſported by the winds from a diſtance, or by ſome plant analogous to it in nature, which grew in the neighbourhood? Add to this, that it is not uncommon to find ſome male flowers upon female plants, and ſome female flowers upon male plants. The maſtich-tree of M. Couſineri furniſhes us with one example. The *gleditſia* of M. Duhamel with a ſecond.

Some authors aſſure us, that having cut off the panicles or heads of Turky corn, and the ſtamina of tulips and other plants, as ſoon as the flowers were ſufficiently unfolded to permit that operation, they found that all the ſeeds had proved abortive. Other authors affirm, that, notwithſtanding theſe operations, they obtained ſome perfect, well-conditioned ſeeds. In the latter caſe, it may reaſonably enough be ſuſpected that the caſtration in queſtion was either not performed before the opening of the ſummits, and diſcharge of the fertilizing duſt; or, at leaſt, was incompleatly performed at the time of its accompliſhment. We may likewiſe obſerve, that, as confeſſedly a few perfect ſeeds only were obtained in conſequence of the caſtration of the ſtamina, thoſe organs may be concluded, if not abſolutely neceſſary, at leaſt, of the higheſt utility to fructification. Thoſe who deny the ſexual diſtinction agree in that utility, but will not allow that it conſiſts in fecundation: they pretend that the caſtrations juſt mentioned are prejudicial to plants, not in depriving them of the fecundating matter, but in ſuppreſſing the organs of ſecretion, and tranſmitting the ſap leſs highly elaborated to the ſeeds. To deſtroy the force of this opinion, we need only obſerve, that the ſeeds prove equally abortive, if deprived of ſtamina produced by other individuals. In this caſe, the preparations or ſecretion made by one tree, can have no influence upon the fruits produced by another tree.

Need I add to what has been already advanced upon this ſubject, that no ſolid objection can be formed of certain extraordinary inſtances, which very rarely occur? Why, for example, it may be aſked, do we ſometimes ſee thoſe panicles of maiz, which commonly bear male flowers only, produce a few ripe and well-conditioned fruits? I anſwer, becauſe, contrary

trary to Nature, a few piſtils are intermingled in the panicle with the male flowers.

THE doctrine of vegetable fecundation is farther ſupported by a variety of arguments drawn from the ſtructure, proportion, ſituation and other circumſtances of the ſexual organs, ſome of which it will not be improper to mention in this place.

1. THE male duſt is diſcharged by its proper organ, at the very time when the ſtigma of the piſtil is in it greateſt vigour, and conſequently beſt diſpoſed to receive the influences of the fecundating matter. This coincidence in point of time is obſerved not only in hermaphrodite plants, and ſuch as have male and female flowers upon the ſame individual; but likewiſe in thoſe plants where the male flowers are produced on one individual, the female flowers on another.

2. AFTER the diſcharge of the *pollen* or powder of the *antheræ*, both ſtamina and piſtils wither, and fall off.

3. THE ſituation of the piſtils with reſpect to the ſtamina appears favourable for the reception of the fecundating duſt. In an upright flower, the antheræ generally equal the ſtigma in height, ſometimes overtop it. In a drooping or inverted flower, as it is ſometimes called, the ſtigma overtops the antheræ, that the duſt when diſcharged downwards may be intercepted in its courſe by the female organ---an event which could never take place, if the ſtamina, as in erect flowers, were either taller than the piſtil, or equal with it in height. A ſituation equally convenient for fecundation is obſerved in thoſe plants which have male and female flowers upon the ſame individual. In

theſe the male flowers are generally placed above the female, either on the ſame or different footſtalks. Saxifrage, and many other plants which have a ſhort piſtil, exhibit an appearance no leſs favourable to the hypotheſis of the ſexes. The antheræ approach, and forming a compact body immediately above the piſtil, diſcharge their whole contents upon the ſtigma.

4. THE greater part of aquatic plants flower only above the water, that the fecundation, as Geſner obſerves, may be performed in air, and the generating ſubſtance may not be diluted by the water. Some plants, it is remarkable, plunge again into the water, as ſoon as fecundation is accompliſhed, and the fruits begin to be formed.

5. THE figure of the pollen in plants of the ſame ſpecies is exactly ſimilar; in thoſe of different ſpecies and genera, its figure is exceedingly diverſified. Hence we may conclude, with ſome degree of probability, that the powder in queſtion, being a compoſition of organized capſules, is not a ſimple excrement or ſecretion, as ſome naturaliſts have pretended, but a *viſcus* eſſentially neceſſary to plants, and whoſe function it is to perpetuate the ſpecies.

FROM this long but neceſſary digreſſion, I return to take a particular review of the Linnæan method of arrangement, which will now, it is hoped, be more eaſily underſtood, as the hypotheſis of the ſexes, upon which it is founded, remains no longer unknown. The method in queſtion ſets out with the following principles.

1. THE fructification is the eſſence of every vegetable.

2. THE

2. The eſſence of the fructification conſiſts in the flower and fruit.

3. The eſſence of the flower conſiſts in the antheræ and ſtigma. Theſe, therefore, conſtitute a flower, whether the calix, *corolla*, or filaments of the ſtamina, are preſent or wanting.

4. The eſſence of the fruit conſiſts in the ſeed. This laſt, therefore, conſtitutes a fruit, whether the ſeed-veſſel be preſent or wanting.

5. The eſſence of every ſeed conſiſts in its *corculum*, which is attached to the lobes and contained within them.

6. The eſſence of the *corculum* of the ſeed conſiſts in the *plumula*, radicle, or *punctum vitæ*, which mounts upwards, and becomes the ſtem or trunk---The lower part of the *corculum* termed *roſtellum*, from its reſemblance to a bird's beak, ſhoots downward into the ſoil, and is the embryo-root.

7. All vegetables are furniſhed with flower and fruit.

8. The *antheræ*, *ſtigma* and ſeed may conſtitute a fructification, with or without the calix, corolla, filaments and ſeed-veſſel. The reaſon is obvious. The *antheræ* and *ſtigma* conſtitute a flower---The preſence of the ſeed conſtitutes a fruit. The flower and fruit together conſtitute a fructification. Therefore, the *antheræ*, ſtigma, and ſeed conſtitute a fructification.

Several Botaniſts, as we have ſeen, had diſtinguiſhed plants into male and female, upon juſt and ſcientific principles,

before the time of Linnæus. That author, however, is the firſt, who, regarding the ſtamina and piſtils as organs eſſentially neceſſary to generation, and conſequently the moſt conſtant in every ſpecies, has rendered their ſuppoſed function, and aſcertained conſtancy uſeful, by making them furniſh the generical and claſſical characters of a plan of arrangement. It is for this reaſon, that the firſt inveſtigators of the ſexes of plants have ſo generally been overlooked, and the doctrine itſelf conſidered as of modern invention. In this reſpect, the Swediſh Botaniſt reſembles the celebrated Harvey, who, by firſt demonſtrating the circulation of the blood, has obtained the honour of that important diſcovery, although the circulation in queſtion had been ſuſpected, and, in ſome inſtances, recognized, long before the æra in which Harvey flouriſhed.

THE hypotheſis of the ſexes, applied to ſcientific arrangement, has enriched Botany with a variety of terms expreſſive of the fancied analogy between plants and animals. Thus *the act of flowering* is denominated *generation*; it becomes the nuptials of the vegetable kingdom. The *maturation* or *act of ripening of the fruit* is termed *the birth*. The parts of fructification, taken conjunctively, are the genitals. The *coralla* forms the *palace* where the nuptials are celebrated; the *calix* is the *conjugal bed*; the *filaments* of the ſtamina are the *ſpermatic veſſels*; the *antheræ* or *ſummits* of the ſtamina correſpond to the *teſtes* in animals; the *powder* or *duſt* contained in the antheræ is the *ſeminal liquor*; the *ſtigma* or *ſummit* of the piſtil correſponds to that part in female animals which ſecretes the *genital lymph*; the *ſtyle* is the *vagina* or *Fallopian tube*; the *germen* or *ſeed-bud* is the *ovary*; the *ſeed-veſſel*, the *fecundated or impregnated ovary*; the *ſeed* is the *egg*; and the concourſe of the *male* and *female organs*, becomes, as in animals, neceſſary to fecundation.

In eſtabliſhing his method, Linnæus has obſerved the following order. The ſtamina or male parts ſerve to diſcriminate the claſſes; the piſtils or female parts generally diſcriminate the orders, which are the firſt ſubdiviſion, and correſpond to the ſections of Tournefort. All the parts of fructification, and none other, are employed in diſtinguiſhing the genera. The remaining parts of plants, particularly the ſtems, leaves and roots, ſerve to characterize the ſpecies. Specific differences are, however, ſometimes derived from circumſtances connected with the parts of fructification, when thoſe circumſtances are not neceſſary for diſtinguiſhing the genera.

The organs of generation in plants, are either diſtinctly or obſcurely viſible.

Plants, in which the organs of generation are apparent, divide themſelves, from the union of the ſexes, or their ſeparation either on the ſame or different individuals, into hermaphrodite, androgynous, male and female. Theſe terms have been already explained; as have likewiſe thoſe of hermaphrodite, male and female, when applied to flowers.

The ſtamina are moſt commonly attached to the receptacle; ſometimes, however, they are inſerted into the calix.---In a few plants, the ſtamina ſtand upon the piſtil.

Sometimes the ſtamina are found totally detached from one another; at other times they are found united, either by the filaments into one, two, or more bundles; or by the *antheræ*, into a cylinder that is perforated by the piſtil.

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THE ſtamina are found either of equal or unequal height. In the latter caſe, there are always two ſtamina ſhorter than the reſt; thoſe which are longer, being ſometimes two, ſometimes four in number.

IN hermaphrodite and male flowers, the number of ſtamina is exceedingly diverſified.

THESE ſix obſervations furniſh the characters of the twenty-four claſſes of which the Linnæan method is compoſed.

FLOWERS which are ſcarcely viſible, and cannot be diſtinctly deſcribed, occupy the twenty-fourth claſs, the laſt of the method, which has therefore obtained the name of *cryptogamia* or the *clandeſtine marriage*; the parts of generation being either entirely hid, or obſcurely viſible. The claſs in queſtion contains all the ſubmarine plants, muſhrooms, moſſes and ferns.

OF flowers which are diſtinctly viſible, ſome are hermaphrodite, that is, have the organs of the two ſexes within the ſame calix and petals; others are male and female, that is, have the ſtamina and piſtils in different flowers. Theſe laſt are contained in three claſſes, the twenty-firſt, twenty-ſecond and twenty-third of the method. They are thus diſtinguiſhed. In the twenty-firſt claſs, the male flowers are ſeparated from the female upon the ſame individual plant. In the twenty-ſecond the flowers of different ſexes are ſeparated from each other upon diſtinct plants. In the twenty-third there is a commixtion of male, female and hermaphrodite flowers upon one or more individuals. The firſt-mentioned claſs is termed *Monoecia*, which ſignifies *one houſe*, the fructification being perfected in

one and the ſame plant. It is exemplified in box, mulberry, arrow-head, walnut, oak, pine, and palma-chriſti. The name *Dioecia*, which ſignifies *two houſes*, is given to the twenty-ſecond claſs, becauſe the fructification, to be perfected, requires the agency of two diſtinct plants. Willow, hemp, hop, mercury, juniper, and butcher's broom afford examples of the claſs in queſtion. The intercommunication of ſexes that obtains in the twenty-third claſs has procured it the name of *Polygamia*, *polygamy* or *many marriages*. It is exemplified in pellitory, croſs-wort, orach, aſh, maple and white hellebore.

THE firſt twenty claſſes contain plants with hermaphrodite flowers only. Theſe are primarily ſubdivided from the ſituation of the ſtamina, which either ſtand round the piſtil, or are attached to it. One claſs only, the twentieth of the method, is occupied by hermaphrodite flowers in which the ſtamina are inſerted into the piſtil. It is termed *Gynandria*, which, ſignifying wife-huſband, ſeems expreſſive of the ſingular union of the male and female organs within the ſame covers. Paſſion-flower, orchis, lady's ſlipper, and arum furniſh examples.

HERMAPHRODITE flowers, which have their male and female parts totally diſtinct, are ſubdivided from the ſeparation or union of the ſtamina. In many plants, the ſtamina are detached ſeparate bodies, being united neither above nor below: in others, they are conjoined either by the filaments or ſummits.

PLANTS which have their ſtamina united by the antheræ or ſummits, are all contained in the nineteenth claſs, which, by our author, is denominated *Syngeneſia*, that is, *Congeneration*; the male or generative parts being combined, and performing

their office in conjunction. This claſs comprehends the compound flowers.

The ſixteenth, ſeventeenth and eighteenth claſſes are occupied by flowers whoſe ſtamina are united by the filaments into one, two or more bundles. To theſe bundles Linnæus has given the name of *Brotherhoods*; for ſo the Greek term compounded with the numerals *one*, *two* and *many*, imports. A ſingle brotherhood characterizes the ſixteenth claſs, hence termed *Monadelphia*. It is exemplified in geranium and the mallow tribe. The pea-bloom flowers rank under the claſs *Diadelphia*, in which there are two brotherhoods, or ſets of united filaments. Many brotherhoods or ſets of united filaments characterize the eighteenth claſs, hence termed *Polyadelphia*. St. John's wort, orange and chocolate-nut afford examples of the claſs alluded to.

Hermaphrodite flowers which have their ſtamina detached and ſeparate, occupy the firſt fifteen claſſes. Theſe are primarily ſubdivided from the proportion which the ſtamina bear to one another. In the fourteenth and fifteenth claſſes, there are always two ſtamina ſhorter than the reſt, which are either two or four in number. If two, they determine the plant to the former of theſe claſſes, which has hence obtained the name of *Didynamia*, that is, *two powers*; if four, to the latter, which, for the ſame reaſon, is diſtinguiſhed by the name of *Tetradynamia*, that is, *four powers*. The lip-flowers arrange themſelves under the firſt; the croſs-ſhaped flowers under the ſecond.

The number of ſtamina is the diſcriminating character of the firſt thirteen claſſes, in which the flowers are hermaphrodite,

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and the male-organs of equal length. The firſt claſs termed *Monandria*, that is a ſingle huſband, contains plants with only one ſtamen or male organ, and is exemplified in Indian flowering-reed and turmerick. The ſecond claſs contains hermaphrodite plants with two ſtamina; the third thoſe with three; the fourth, four; the fifth, five; the ſixth, ſix; the ſeventh, ſeven; the eighth, eight; the ninth, nine; the tenth, ten; the eleventh, twelve. The names of all theſe claſſes are regulated by the numeral, which varies in each; the ſexual term remaining invariably the ſame. This obſervation may be extended to the twelfth and thirteenth claſſes, the only two of the Linnæan method, whoſe characters remain unexplored. The firſt-mentioned claſs is denominated *Icoſandria*; the other *Polyandria*; terms which import the number of ſtamina to be twenty in the former, and indefinite in the latter. It is not, however, by this characteriſtic that we are to diſtinguiſh the plants of either claſs. In both, the number of ſtamina is equally undetermined; their inſertion only is different. In the claſs *Icoſandria*, the male organs, frequently twenty, are attached to the calix; in the claſs *Polyandria*, thoſe organs are inſerted into the common receptacle of the flower. Roſe, cinquefoil, ſtrawberry, formentil, medlar, apple, and pomegranate are referred to the former; poppy, larkſpur, monk's hood, water-lilly, magnolia, ranunculus, adonis, meadow-rue, anemony, with many others, arrange themſelves under the latter.

SUCH are the outlines of the Linnæan method of arrangement. A more particular delineation will not be expected in this place, as the characters of each claſs fall more properly to be enumerated hereafter. We ſhall however, as uſual, preſent the

reader with a familiar example, leaving him to judge, from the eaſe or difficulty of its reference, whether facility, or the contrary quality, be the diſtinguiſhing characteriſtic of the method before us. Let STOCK be the propoſed example. I am required to refer it to its proper claſs in the ſexual method. Inſtructed in the principles and analyſis of that method, I pluck up ſeveral ſtalks of the plants taking care that they are furniſhed with flowers and fruit. The appearance of theſe parts of fructification, upon which the ſyſtem is founded, immediately pronounces my plant to be excluded from the twenty-fourth claſs, in which the flower and fruit are either wanting, or obſcurely viſible.

I DISTINGUISH in all the flowers which I examine, both ſtamina and piſtils---they are therefore hermaphrodite; and cannot conſequently be arranged under the three preceding claſſes, the twenty-firſt, twenty-ſecond, and twenty-third, which contain either male and female flowers only, or an intercommunication of males, females and hermaphrodites, upon the ſame or different individuals.

I EXAMINE the ſtamina in particular. I obſerve that they are not attached to the piſtil; that, on the contrary, they ſtand around it, and are inſerted into the common receptacle of the fructification. My plant, then, does not pertain to the twentieth claſs; for, in it, the ſtamina ſtand upon the piſtil.

I NEXT obſerve that the ſtamina are neither conjoined by the filaments, nor by the *antheræ*; I conclude therefore, that the plant to be explored is not to be found in the ſixteenth, ſeventeenth, eighteenth or nineteenth claſſes, in which the union of

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the upper or lower parts of the male organ is the diſcriminating character.

I COMPARE the proportion and ſize of the ſtamina. I diſcover that they are of unequal height; two of them being conſiderably ſhorter than the reſt. In the firſt thirteen claſſes, therefore, I in vain look for my plant, becauſe in them the ſtamina are of equal height. There remain but two claſſes, the fourteenth and fifteenth, which agree in having unequal ſtamina, but differ in the number of thoſe organs. The firſt-mentioned claſs contains flowers with only four ſtamina: but ſtock, the plant to be detected, bears ſix ſtamina; therefore ſtock arranges itſelf under the claſs *Tetradynamia*, the fifteenth in the method, the characteriſtic of which is, ſix ſtamina, four longer than the reſt.

THE ORDERS or primary ſubdiviſions of the ſexual method are generally eſtabliſhed from the piſtils or female organ, in like manner as the claſſes are founded upon the ſtamina or male organ.

IN flowers which are provided with the piſtil, namely, in hermaphrodites and females, that organ, like the ſtamina, is greatly diverſified in reſpect of number.

THE number of piſtils is reckoned from the baſe of the ſtyle, and not from its upper extremity, termed the *ſtigma*, which is ſometimes found divided in flowers that are notwithſtanding adjudged to have but one piſtil. When the ſtyle is wanting, as in the gentians, the number of female organs is regulated by that of the *ſtigmata*, which, in the caſe alluded to, adhere to the *germen* or ſeed-bud.

Upon theſe principles are founded the diſtinctions of the orders or ſecondary diviſions in the Linnæan method. Their names, like thoſe of the claſſes, the author has borrowed from the Greek; and each name is expreſſive of the character of that particular order which it is employed to denominate.

It is ſcarce needful to obſerve, that the ſame character may be employed in diſcriminating the orders of ſeveral claſſes. The greater the uniformity that obtains in the inferior as well as primary branches of any method, the nearer is that method to perfection.

The moſt general character of the orders is drawn from the number of piſtils; accordingly the firſt order of a claſs comprehends flowers which have but one piſtil. It is termed *Monogynia*, that is, a ſingle female.

The ſecond order comprehends flowers which have two piſtils. It is called *Digynia*, that is, two females.

The third order contains flowers with three piſtils, and is termed *Trigynia*, that is, three females.

The fourth order contains flowers with four piſtils. It is termed *Tetragynia*, that is, four females.

The fifth order contains flowers which have five piſtils, and is denominated *Pentagynia*, that is, five females.

The ſixth order contains flowers with ſix piſtils. It is called *Hexgynia*, that is, ſix females.

Lastly,

LASTLY, that order which contains flowers with an indeterminate number of piſtils, is termed *Polygynia*, that is, many females.

IN this manner are ſubdivided the firſt thirteen claſſes. A plant, whoſe flower is furniſhed with only one ſtamen, and one piſtil, is ſaid to pertain to the claſs and order *Monandria-Monogynia*; if with one ſtamen it has two piſtils, it ranges under *Monandria-Digynia*; if two ſtamina and three piſtils, under *Diandria-Trigynia*; and ſo of others.

WE ſay, in like manner, *Pentandria-Monogynia*, to expreſs the claſs and order of hermaphrodite flowers which have five diſtinct, equal ſtamina, and one piſtil; *Pentandria-Digynia*, *Trigynia*, *Tetragynia*, *Pentagynia*, when with the ſame number of ſtamina, the flowers have two, three, four or five piſtils.

THE fourteenth claſs, *Didynamia*, is ſubdivided into two orders, whoſe characteriſtic diſtinction is drawn from the diſpoſition of the ſeeds. In the firſt order, termed *Gymnoſpermia*, the flowers are furniſhed with four naked ſeeds in the bottom of a permanent calix, which performs the function of an ovary or *uterus*. In the ſecond order, called *Angioſpermia*, the ſeeds are contained in a proper ovary or ſeed-veſſel. The lip-flowers arrange themſelves under the firſt order; *thoſe whoſe petal reſembles the ſnout of ſome animal*, of Tournefort, rank under the ſecond. The terms *Gymnoſpermia* and *Angioſpermia* are expreſſive of the particular character of each order; the former ſignifying a *naked ſeed*; the latter, a ſeed *contained in a veſſel*.

IN the fifteenth claſs, *Tetradynamia*, are two ſecondary diviſions or orders; their diſtinctive character is drawn from the

figure of the ſeed-veſſel, which, in the plants of this claſs, is denominated *Siliqua*, a ſpecies of pod. In the firſt order, termed *Siliculoſæ*, that is, leſſer *Siliquæ* or pods, the ſeed-veſſel is ſhort, almoſt round, and furniſhed with a ſtyle that is nearly equal to it in length. In the ſecond order, denominated *Siliquoſæ*, the ſeed-veſſel is long, tapering, and furniſhed with a ſhort ſtyle. *Alyſſum*, ſcurvy-graſs, candy-tuft, honeſty, and dittander furniſh examples of the firſt order; lady's ſmock, wall-flower, rocket, and ſea-cabbage of the ſecond.

In the three following claſſes, the characters of the orders are derived from the number of ſtamina. *Monadelphia*, the ſixteenth, contains five orders, which take the name of *Pentandria*, *Decandria*, *Endecandria*, *Dodecandria*, and *Polyandria*, from the number of united ſtamina, which, in the different orders, are five, ten, eleven, twelve, or many. In like manner, the claſs *Diadelphia*, the ſeventeenth of the method, which comprehends flowers with two ſets or bundles of united filaments, is ſubdivided into three orders, termed *Hexandria*, *Octandria*, *Decandria*. The flowers of *Diadelphia-Hexandria* are ſuch as have ſix ſtamina united by the filaments into two bundles. The flowers of *Diadelphia-Octandria* have eight ſtamina ſo conjoined. Thoſe of *Diadelphia-Decandria*, which are by much the greater number, have ten ſtamina united by their filaments into two bundles. Fumatory and milk-wort ſerve to exemplify the firſt and ſecond orders; lupine, trefoil, coronilla and the other pea-bloom flowers arrange themſelves under the third. The eighteenth claſs, *Polyadelphia*, has three orders, which, like thoſe of the two preceding claſſes, reſpect the number of ſtamina of which the ſeveral bundles conſiſt. Their names are *Polyadelphia-Pentandria*, *Icoſandria*, *Polyandria*.

The orders of the nineteenth claſs, *Syngeneſia*, are more complex, and their characters of leſs eaſy acquiſition. They ariſe from the different modes of intercommunication of the florets of which the aggregate is compoſed. To that commixtion or intercommunication Linnæus has given the name of Polygamy,---a term which, when applied to plants, is expreſſive of the intercommunication of flowers of different ſexes upon the ſame or different individuals; when applied to flowers, as in the preſent caſe, is expreſſive of the intercourſe of male, female and hermaphrodite florets within the ſame head or aggregate.

In the firſt order of the claſs under review, the florets are all hermaphrodite, as well thoſe in the circumference or ray, as thoſe in the centre or diſc. This mode of intercommunication Linnæus has denominated Equal Polygamy; by which name he has likewiſe characterized the order in queſtion. All the ſemifloſcular compound flowers of Tournefort, and many of the floſcular, particularly burdock, artichoke, ſaw-wort and thiſtle, afford familiar examples of the equal polygamy alluded to.

In the ſecond order, the florets in the centre or diſc are hermaphrodite, thoſe in the margin or ray female. This kind of Polygamy is termed Superfluous, becauſe the fructification being perfected in the florets of the diſc, the preſence of the female florets of the ray is unneceſſary. Tanſy, wormwood, aſter, golden-rod and feverfew, furniſh examples of the order in queſtion.

In the third order, the florets in the diſc are hermaphrodite; thoſe in the circumference are neuter, or prove abortive. To

this order Linnæus has given the name of Fruſtraneous or Ineffectual Polygamy, becauſe the florets in the ray, being of no ſex or proving abortive, are totally uſeleſs to the fructification. Sun-flower, and centaury afford proper examples.

In the fourth order, the flowers of the diſc are male, thoſe of the margin are female. This intercommunication of polygamy is termed, properly enough, *neceſſary*, becauſe the fructification not being perfected ſeparately, either in the florets of the diſc or ray, the preſence of male and female florets becomes abſolutely neceſſary for compleating fecundation, and preventing the flowers from proving abortive. Under this order rank marigold, cotton-wood, and ſome other flowers, moſtly radiated.

The fifth order of the claſs ſyngeneſia is termed *Polygamia ſegregata*, ſeparate or detached polygamy; the florets, which compoſe the aggregate, being ſeparated from each other, by means of partial flower-cups that ſupport one or more florets, and ſtand within a common calix. Globe-thiſtle, and *Gundelia* afford examples of the ſegregation alluded to.

The ſixth and laſt order is denominated *Monogamia*, that is, *a ſingle marriage*, becauſe the flowers, which arrange themſelves under it, are ſimple, and conſequently exhibit none of thoſe caſes of polygamy which ſo remarkably characterize the other orders. It is exemplified in balſam, violet, and cardinal flower.

The following claſſes, from the twentieth to the twenty-third, both incluſive, draw the diſtinction of their orders from the characters of all the preceding claſſes. Thus, *Gynandria*, the twentieth claſs, which comprehends hermaphrodite flowers whoſe

whoſe ſtamina are attached to the piſtil, is ſubdivided from the number of ſtamina into ſeven orders, the names of which correſpond to thoſe of the claſſes whoſe character they bear. In like manner, *Monoecia*, the twenty-firſt claſs, which contains *androgynous* plants, or ſuch as bear male and female flowers upon different parts of the ſame individual, is ſubdivided into eleven orders, termed *Monandria*, *Diandria*, *Triandria*, *Tetrandria*, *Pentandria*, *Hexandria*, *Heptandria*, *Polyandria*, *Monadelphia*, *Syngeneſia*, *Gynandria*. The firſt eight orders ariſe from the number of ſtamina, which, in the male flowers of thoſe orders, are one, two, three, four, five, ſix, ſeven, or many. The male flowers of *Monoecia-Monadelphia* have their ſtamina united by the filaments into a ſingle bundle, as in the claſs of hermaphrodite flowers which bears the ſame denomination. The male flowers of *Monoecia-Syngeneſia* have their ſtamina united by the *antheræ* or ſummits, as in the claſs of compound flowers. Laſtly, in *Monoecia-Gynandria*, the ſtamina are inſerted into the place which the piſtil would have occupied, had the flowers been hermaphrodite. The orders in the claſs *Dioecia* are eſtabliſhed upon exactly the ſame principles. In *Polygamia*, the twenty-third claſs, the ſecondary diviſions are conſtituted from the number of plants upon which the polygamy is ſeated. *Polygamia-Monoecia* has the polygamy on a ſingle plant, and is exemplified in plantain-tree, pellitory, croſs-wort and acacia. *Polygamia-Dioecia* comprehends plants which have the polygamy on two diſtinct individuals. Aſh and triple-thorned-acacia afford proper examples. *Polygamia-Trioecia*, the laſt order of the claſs in queſtion, contains plants which have the polygamy on three diſtinct individuals. Under this order rank only two genera, viz. fig, and carob-tree, or St. John's bread.

LASTLY, the twenty-fourth claſs, *Cryptogamia*, not furniſhing diviſions from the parts of fructification, which often elude obſervation, is ſubdivided, from the general habit, into four orders or families, that are eaſily diſtinguiſhed. Theſe are 1. Ferns. 2. Moſſes. 3. Submarine plants or Sea-weed. 4. Muſhrooms.

THE following works of Linnæus are arranged according to the ſyſtem which has juſt been delineated.

Flora Lapponica, publiſhed at Amſterdam, octavo, in 1737.

Viridarium Cliffortianum, octavo, publiſhed in the ſame year, and at the ſame place.

Hortus Cliffortianus, folio, publiſhed at Amſterdam in 1737.

Flora Suecica, octavo, publiſhed at Stockholm in 1745.

Flora Zeylanica, octavo, publiſhed at Stockholm in 1747.

Hortus Upſalienſis, octavo, publiſhed at Stockholm in 1748.

Materia Medica, octavo, publiſhed at Stockholm in 1749.

Species Plantarum, publiſhed at Stockholm, in two volumes octavo, in 1753. The laſt edition, being the third, is printed in 1764.

Genera Plantarum. The laſt edition, being the ſixth, contains 1239 genera, and is publiſhed in one volume octavo, at Stockholm in 1764.

Syſtema Naturæ. The twelfth edition is publiſhed at Stockholm, in three volumes octavo, in 1767.

THE authors, who have followed the Linnæan ſyſtem, are,

JOHN GRONOVIUS, in his *Flora Virginica*, publiſhed at Leyden in 1739; and in his *Flora orientalis Rauwolfii*, publiſhed in octavo, at the ſame place, in 1755.

MR. BROWN, in his Natural Hiſtory of Jamaica, publiſhed in 1756.

M. JACQUIN, in his Enumeration of American Plants, publiſhed at Leyden, in twelves, in 1762.

A SYNOPSIS,

Astronomy

A

SYNOPSIS,

EXHIBITING

The eſſential or ſtriking Characters which ſerve to diſcriminate Genera of the ſame Claſs and Order:

AS LIKEWISE

The ſecondary Characters of each Genus, or thoſe derived from the Port, Habit or general Appearance of the Plants which compoſe it.

Si omnium generum CHARACTERES ESSENTIALES *detecti eſſent, facillima evaderet plantarum cognitio.* Lin. Phil. Bot. p. 130.

Facies plantarum (ſeu HABITUS*) magni ab omni Botanico facienda eſt.* Ibid. p. 139.

SYNOPSIS of the GENERA.

CLASS I.

MONANDRIA.

THIS claſs conſiſts of plants with hermaphrodite flowers which are furniſhed with one ſtamen, chive, thread or male organ. It is ſubdivided, from the number of piſtils or female organs, into two orders.

ORDER I.

MONANDRIA-MONOGYNIA.

Plants with one ſtamen and a ſingle piſtil or ſtyle.

UNDER this order rank eleven genera, which form the two following ſubdiviſions.

DIVISION THE FIRST.

Plants with a ſingle ſtamen and ſtyle, which have their ſeeds, generally numerous, contained in a ſeed-veſſel that is divided internally into two or three partitions, and placed under the receptacle or ſeat of the flower.

AMOMUM.

(Lin. Gen. Plant. 2.)

Upper part of the flower divided deeply into three ſegments.

Tube or lower part ſhort.

THE roots of this genus are fleſhy, tuberous and jointed. The ſtem is like that of the graſſes. The leaves are placed alternately, and form a ſheath round the ſtem. The flowers are diſpoſed in a ſpike upon a footſtalk, which proceeds immediately from the root, at a diſtance from the ſtem and leaves.

CURCUMA.

(Lin. Gen. Plant. 6.)

Five ſtamina, four of which are imperfect, wanting tops.

SECONDARY CHARACTERS. Root fleſhy. Stem graſſy, and formed of the oſculations of the leaves, which reſemble thoſe of the laſt genus. Flowers diſpoſed in a ſpike upon a footſtalk which emerges from the centre of the radical leaves.

THALIA.

(Lin. Gen. Plant. 8.)

Flower conſiſting of five petals.

Seed-veſſel, a fruit of the cherry-kind, containing a ſtone with two internal diviſions.

THIS genus, in its whole habit and ſtructure, greatly reſembles the next, viz.

MARANTA.

MARANTA.

(Lin. Gen. Plant. 5.)

Flower of the gaping or grinning kind.

Upper part cut into ſix irregular diviſions, two of which ſpread more than the reſt.

SECONDARY CHARACTERS. Root fleſhy and full of knots. Stem and leaves like thoſe of the reed. Sheath formed by the leaves round the ſtem ſurmounted by a footſtalk which is frequently very long, cylindrical, without a furrow, and with a ſwelling that imitates an articulation or joint. Flowers diſpoſed in a panicle or looſe ſpike, which terminates the ſtem.

KÆMPFERIA.

(Lin. Gen. Plant. 7.)

Flower deeply divided into ſix parts; three of which are larger and ſpread; and one is ſubdivided into two.

THIS genus in habit and ſtructure reſembles *Curcuma*, deſcribed above.

CANNA.

(Lin. Gen. Plant. 1.)

Flower-cup conſiſting of three leaves.

Petal deeply divided into ſix parts, one of which is turned backwards.

Style ſpear-ſhaped and faſtened to the irregular petal.

SECONDARY CHARACTERS. Roots fleſhy, tuberous, and ſpreading horizontally under the ſurface of the ground. Stem like that

of the graſſes. Leaves ſimple, entire, alternate, and ſurrounding the ſtem like a glove or ſheath. Flowers diſpoſed in a ſpike that terminates the ſtem.

ALPINIA.

(Lin. Gen. Plant. 4.)

Petal divided into ſix unequal ſegments; two of which are notched or deficient in the margin.

Bottom of the flower inflated.

In habit and ſtructure, this genus reſembles Indian flowering reed, juſt deſcribed.

COSTUS.

(Lin. Gen. Plant. 3.)

Flower conſiſting of three petals.

Nectarium or inner flower, of the lip or grinning kind, and inflated: the lower lip divided into three parts.

SECONDARY CHARACTERS. Roots fleſhy and jointed. Stem cylindrical. Leaves ſimple, oblong, forming an entire ſheath round the ſtalk. Flowers terminating the ſtem in ſpikes or thick heads.

DIVISION THE SECOND.

Plants with a ſingle ſtamen and ſtyle, which bear one naked ſeed.

BOERHAVIA.

(Lin. Gen. Plant. 9.)

Flower-cup wanting.

Flower conſiſting of one petal that is bell-ſhaped.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous, branched and leafy. Leaves ſimple, entire, oppoſite, and

furniſhed with a footſtalk. Flowers ſtanding upon footſtalks, and diſpoſed in umbels or ſpikes, which either terminate the branches, or proceed from the angles of the leaves.

OBSERVATION. All the ſpecies of this genus are remarkably glutinous, particularly the ſeeds.

HIPPURIS.

(Lin. Gen. Plant. 11.)

Flower-cup and petals wanting.

SECONDARY CHARACTERS. Roots jointed, horizontal, with perpendicular radicles or ſtrings. Stem jointed, herbaceous. Leaves growing in whirls round the joints of the ſtalk. Flowers ſeated in the wings of the leaves, without footſtalks.

SALICORNIA.

(Lin. Gen. Plant. 10.)

Flower-cup conſiſting of one leaf.
Petals wanting.

SECONDARY CHARACTERS. Roots branched. Stem jointed, ſucculent; the branches oppoſite. Leaves wanting. Flowers ſeated in the joints of the ſtem.

OBSERVATION. In ſome ſpecies of this genus, two ſtamina have been diſcovered.

GENERAL REMARK.

To this order of the firſt claſs, Linnæus, in ſtrict conformity to the rules of arrangement, ought to have referred two ſpecies of valerian, viz. red valerian, and that with ſtar-thiſtle leaves, the *valeriana rubra* and *calcitrapa* of our author: both of which, although furniſhed with only a ſingle ſtamen, are placed with the other valerians in the third claſs.

ORDER II.

MONANDRIA-DIGYNIA.

Plants with a ſingle ſtamen and two piſtils or ſtyles.

CORISPERMUM.

(Lin. Gen. Plant. 12.)

Flower-cup wanting.

Petals two in number.

A ſingle ſeed, that is oval and naked.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous and branched. Leaves ſimple and alternate. Flowers placed ſingly in the arm-pits of the leaves.

OBSERVATION. The lowermoſt flowers in plants of this genus are frequently found furniſhed with two, three, four or five ſtamina; the reſt have always one only. Adanſon affirms, that there are frequently found female flowers intermixed with the hermaphrodite upon the ſame plant.

CALLITRICHE.

(Lin. Gen. Plant. 13.)

Flower-cup wanting.

Petals two in number.

Seed-veſſel, a capſule with two cells, each incloſing the ſame number of ſeeds.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous and branched. Leaves ſimple, entire, oppoſite, and ſeated immediately upon the branches without any footſtalk. Flowers produced either ſingly or by twos upon footſtalks which iſſue from the angles or arm-pits of the leaves.

BLITUM.

(Lin. Gen. Plant. 14.)

Flower-cup deeply cut into three ſegments.

Petals wanting.

A ſingle ſeed contained in the permanent flower-cup, which ſwells into a berry.

SECONDARY CHARACTERS. Roots branched. Stem herbaceous, and branched. Leaves ſimple, ſcattered, alternate. Flowers collected into heads in the arm-pits of the leaves.

CINNA.

(Lin. Gen. Plant. 15.)

A ſingle flower contained within a huſky calix of two valves.

Two huſky valves or leaves within the former, performing the office of petals.

A ſingle cylindrical naked ſeed.

OBSERVATION. This genus of plants is diſtinguiſhed from all the other graſſes by its ſingle ſtamen or chive.

CLASS

CLASS II.

DIANDRIA.

THIS claſs conſiſts of hermaphrodite flowers with two equal ſtamina, that are unconnected either by the filaments or tops. It is ſubdivided into three orders whoſe characteriſtic diſtinction, as in the former claſs, is derived from the number of piſtils, ſtyles or female organs.

ORDER I.

DIANDRIA-MONOGYNIA.

Plants having two ſtamina and one piſtil or ſtyle.

DIVISION THE FIRST.

Plants with regular flowers of one petal.

OLEA.

(Lin. Gen. Plant. 20.)

Upper part of the funnel-ſhaped petal ſplit into four diviſions, that are nearly egg-ſhaped.

Seed-veſſel of the cherry-kind, incloſing an oblong wrinkled ſtone.

Summit of the ſtyle divided into two.

SECONDARY CHARACTERS. Roots woody, branched. Stem woody. Leaves ſimple, oppoſite, undivided. Flowers proceed

ceed ſingly from the arm-pits of the leaves. In American olive they are diſpoſed in ſhort cluſters.

OBSERVATION. The ſpecies juſt mentioned ought certainly to have ranked in the twenty-third claſs, *Polygamia*, becauſe of the commixtion of male, female and hermaphrodite flowers upon the ſame individual, which confeſſedly characterizes the ſpecies in queſtion.

CHIONANTHUS.

(Lin. Gen. Plant. 21.)

Upper part of the petal cut into four ſegments that are ſlender and very long.

Seed-veſſel a roundiſh fruit of the cherry kind, incloſing a ſtreaked or furrowed ſtone.

Summit of the ſtyle divided into three.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem ſhrubby. Leaves ſimple, entire, oppoſite. Flowers terminate the ſtem in looſe bunches.

OBSERVATION.---The number of ſtamina in this genus is frequently three.

PHILLYREA.

(Lin. Gen. Plant. 19.)

Upper part of the petal ſplit into four ſegments which are turned backwards.

Seed-veſſel, a berry containing one ſeed.

SECONDARY CHARACTERS. Roots branched and ligneous. Stem woody. Leaves ſimple, entire, oppoſite. Flowers collected in an aggregate or head in the arm-pits of the leaves.

LIGUSTRUM.

(Lin. Gen. Plant. 18.)

Upper part of the petal cut into four.

Seed-veſſel, a berry containing four ſeeds.

SECONDARY CHARACTERS. Roots branched, and woody. Stem ſhrubby. Leaves ſimple, undivided, oppoſite. Flowers produced in cluſters which terminate the branches.

SYRINGA.

(Lin. Gen. Plant. 22.)

Upper part of the petal ſplit into four diviſions, that are ſlender and turned inwards.

Seed-veſſel, a capſular fruit with two cells.

SECONDARY CHARACTERS. Roots branched and woody. Stem ſhrubby. Leaves ſimple, oppoſite. Flowers terminate the ſtem and branches in erect, compact panicles or cluſters.

OBSERVATION. In a ſpecies of *Syringa*, ſome of the leaves are deeply jagged, ſo as nearly to reſemble thoſe compound leaves, termed, by Botaniſts, *pinnated* or *winged* leaves.

ERANTHEMUM.

(Lin. Gen. Plant. 23.)

Upper part of the petal ſplit into five (ſometimes four) ſegments, that are flat and ſhaped like an inverted egg.

Tube of the petal very long and ſlender like a thread.

Summits of the ſtamina overtopping the tube of the petal.

Summit of the ſtyle undivided.

Seed-veſſel, a capſular fruit.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem woody. Leaves ſimple, and oppoſite. Flowers terminate the branches in ſpikes.

JASMINUM.

(Lin. Gen. Plant. 17.)

Upper part of the petal cut into five diviſions.

Summits of the ſtamina placed within the tube of the petal.

Seed-veſſel, a berry with two cells, each containing a ſingle ſeed that is wrapped up in its *arillus* or proper covering.

SECONDARY CHARACTERS. Roots branched, and woody. Stem ſhrubby, and branched. Leaves, in different ſpecies, ſimple, winged, and trifoliate; oppoſite and alternate. Flowers terminate the branches in looſe heads.

NYCTANTHES.

(Lin. Gen. Plant. 16.)

Flower-cup cut into eight parts.

Upper part of the petal ſplit into the ſame number of diviſions.

Seed-veſſel, a twin-fruit with two cells, each containing a ſingle ſeed.

SECONDARY CHARACTERS. Roots branched. Stem ſhrubby. Leaves ſimple, entire, oppoſite. Flowers diſpoſed in ſmall bunches, which proceed from the arm-pits of the leaves, or terminate the branches.

OBSERVATION. In the different ſpecies, the leaves grow oppoſite, either by twos or threes.

DIVISION THE SECOND.

Plants with regular flowers having more petals than one.

CIRCÆA.

(Lin. Gen. Plant. 24.)

A flower-cup of two leaves.
Peals two in number, ſhaped like an inverted heart.
Seed-bud placed below the ſeat of the flower.
Seed-veſſel, a briſtly capſule with two cells, each containing a ſingle ſeed.

SECONDARY CHARACTERS. Roots branched. Stem herbaceous, generally ſimple. Leaves ſimple, entire, oppoſite, and ſtanding upon footſtalks. Flowers terminate the ſtem in ſpikes.

DIALIUM.

(Lin. Mantiſſa Plant. 1240.)

Flower-cup wanting.
Petals five in number.

SECONDARY CHARACTERS. Roots branched and ligneous. Stem woody. Leaves alternate, pinnated or winged. Flowers diſpoſed in looſe heads.

DIVISION

DIVISION THE THIRD.

Plants with irregular flowers of one petal and a dry capsular fruit.

* * By irregular flowers I mean such whose divisions are unequal in figure, magnitude or situation.

PÆDEROTA.

(Lin. Gen. Plant. 26.)

Flower-cup deeply divided into five parts.
Petal cut slightly into four divisions.
Style permanent.
Capsule divided internally into two cells.

This genus in habit and structure greatly resembles the next, viz.

VERONICA.

(Lin. Gen. Plant. 25.)

Flower-cup deeply divided into four parts.
Upper part of the petal split into four divisions, the lowermost of which is narrower than the rest.

Secondary characters. Roots fibrous. Stem branched, creeping or erect. Leaves simple, entire; and in the different species, opposite, alternate, or produced in whirls round the stem. Flowers proceed either singly from the arm-pits of the leaves, or terminate the stem in spikes, which, in some species, are compact, in others, loose.

GRATIOLA.

GRATIOLA.

(Lin. Gen. Plant. 29.)

Upper diviſion of the petal turned backwards, and broader than the three others which are equal.

Four ſtamina of unequal length; the two ſhorteſt of which are barren, or want the ſummits.

SECONDAY CHARACTERS. Roots fibrous, knotty, and ſpreading horizontally under the ſurface of the ground. Stem herbaceous, angular. Leaves ſimple, entire, oppoſite, and ſeated upon the plant without any footſtalk. Flowers ſtand ſingly upon footſtalks which proceed from the arm-pits of the leaves. Two ſlender, floral leaves ſtationed at the baſe of each flower.

OBSERVATION. In a ſpecies of this genus, the *Gratiola Monnieria* of Linnæus, the four ſtamina are all perfect, being furniſhed each with its proper *anthera* or ſummit. That ſpecies therefore ought undoubtedly to be arranged under the fourteenth claſs, *Didynamia*, whoſe characteriſtic is four ſtamina, two longer than the reſt.

SCHWENCKIA.

(Lin. Gen. Plant. 1233.)

Flower nearly regular.

Chaps or jaws of the petal inflated, glandular, and furniſhed with five plaits, reſembling a ſtar, which cloſe the orifice.

Five ſtamina of unequal length; the three ſhorteſt of which are hairy, and want the *antheræ* or ſummits.

SECONDARY

SECONDARY CHARACTERS. There is only one ſpecies of this genus. It is an annual, whoſe leaves are oval, entire, alternate, and ſtand upon footſtalks.

JUSTICIA.

(Lin. Gen. Plant. 27.)

Flower of the gaping or lip kind.
Summits of the ſtamina ſplit into two at the baſe.
Capſule opening with an elaſtic ſpring, and ejecting the ſeeds.

SECONDARY CHARACTERS. Roots branched. Stem in different ſpecies, woody and herbaceous. Leaves ſimple, entire, oppoſite, and placed upon footſtalks. Flowers proceed ſingly or in ſpikes from the arm-pits of the leaves. Three floral leaves ſtationed at the baſe of each flower.

DIANTHERA.

(Lin. Gen. Plant. 28.)

Flower of the gaping or lip kind.
Two *antheræ* or ſummits on each filament.

OBSERVATION. By this laſt character, the genus in queſtion may always with facility be diſtinguiſhed from the former, which in other circumſtances it greatly reſembles.

PINGUICULA.

(Lin. Gen. Plant. 30.)

Flower-cup conſiſting of two irregular lips; the uppermoſt divided into three ſegments; the lowermoſt into two, that are turned backwards.

Petal of the grinning or lip kind, and terminated by a ſpur.

Capſule undivided internally.

SECONDARY CHARACTERS. Stem herbaceous and devoid of leaves. Leaves ſimple, alternate, ſeated near the root, fat and glandular. Flowers produced ſingly at the extremity of the ſtem, which in this genus ſerves for a flower-ſtalk only.

UTRICULARIA.

(Lin. Gen. Plant. 31.)

Flower-cup conſiſting of two diſtinct leaves that are equal.

Petal of the grinning or lip kind, and terminated by a ſpur.

Capſule undivided internally.

GENERAL REMARK.

To this diviſion of the ſecond claſs ought to have been referred a ſpecies of trumpet-flower, the *Bignonia Catalpa* of Linnæus, which, although it invariably bears two ſtamina only, is arranged with the other ſpecies of *Bignonia* under a claſs containing four ſtamina, two of which are long and two ſhort.

DIVISION THE FOURTH.

Plants with irregular flowers of one petal, and naked ſeeds.

VERBENA.

(Lin. Gen. Plant. 32.)

Flower-cup with five indentments, the uppermoſt of which appears chopped or bitten.

Petal nearly regular; the tube crooked.
Four filaments, two ſhorter than the reſt, with two or four crooked ſummits.
Seeds, two or four in number.

OBSERVATION. The reader will ſee the abſurdity of arranging a number of plants which have four perfect ſtamina under a claſs whoſe characteriſtic diſtinction is two ſtamina only. In fact, no leſs than eight different ſpecies of vervain are thus miſplaced, contrary to all the rules of method and ſyſtematic preciſion.

SECONDARY CHARACTERS. Roots branched. Stem ſquare, branched. Leaves ſimple, oppoſite, generally entire, ſometimes jagged. Flowers diſpoſed in compact or looſe ſpikes, which emerge from the arm-pits of the leaves, or terminate the ſtem and branches.

LYCOPUS.

(Lin. Gen. Plant. 33.)

Petal nearly regular; the uppermoſt diviſion notched.
Stamina placed aſunder.
Four roundiſh ſeeds.

SECONDARY CHARACTERS. Roots fibrous. Stem ſquare, branched, Leaves ſimple, oppoſite, jagged. Flowers without footſtalks, and diſpoſed in whirls round the ſtem at the inſertion of the leaves.

AMETHYSTEA.

(Lin. Gen. Plant. 34.)

Flower-cup nearly bell-ſhaped.

Upper part of the petal cut into five diviſions that are almoſt equal; the lowermoſt hollow and more ſpreading.
Stamina placed cloſe together.
Seeds four in number and bunched.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous. Leaves oppoſite, jagged. Flowers ſtanding upon footſtalks, and diſpoſed in ſmall umbels, at the extremity of the branches.

ZIZIPHORA.

(Lin. Gen. Plant. 36.)

Flower of the gaping or lip kind.
Helmet or upper lip entire, and turned backwards.
Four ſeeds, bunched on one ſide, angular on the other.

SECONDARY CHARACTERS. Roots fibrous. Stem ſomewhat ſquare, much branched, herbaceous. Leaves ſimple, entire, oppoſite. Flowers ſtanding upon footſtalks, and diſpoſed in ſmall whirls round the joints of the ſtem.

MONARDA.

(Lin. Gen. Plant. 37.)

Flower of the gaping or lip kind.
Helmet or upper lip of the petal narrow, entire, of equal breadth throughout, and involving the ſtamina and ſtyle.
Four roundiſh ſeeds.

OBSERVATION.

OBSERVATION. In one ſpecies of this genus, the *Monarda Didyma* of Linnæus, there are four filaments, two of which only are genuine ſtamina; the remaining two, which are ſhorter, wanting the ſummits.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous, branched, ſquare. Leaves ſimple, oppoſite. Flowers terminating the branches in heads, or diſpoſed in whirls round the joints.

ROSMARINUS.

(Lin. Gen. Plant. 38.)

Flower of the gaping or lip kind.
Helmet or upper lip of the petal deeply cut into two; the margins turned backwards.
Filaments of the ſtamina long, crooked, indented, and inclined towards the upper lip of the petal.

SECONDARY CHARACTERS. Roots woody, branched. Stem ſhrubby. Leaves ſimple, entire, turned back at the edges, without footſtalks, oppoſite. Flowers proceed ſingly from the arm-pits of the leaves, and ſtand upon footſtalks.

SALVIA.

(Lin. Gen. Plant. 39.)

Flower of the gaping or lip kind.
Stamina fixed tranſverſely near the middle to ſhort footſtalks.

OBSERVATION. Theſe forked ſtamina eſſentially diſtinguiſh all the ſpecies of ſage from the former genus, roſemary, to which the flowers have otherwiſe a reſemblance.

SECONDARY CHARACTERS. Roots branched. Stems generally herbaceous, branched, ſquare. Leaves ſimple, oppoſite; the lower ſtanding upon footſtalks, the upper placed immediately upon the ſtem and branches. Flowers terminate the ſtem in looſe or whirled ſpikes, and ſtand upon footſtalks. In many of the ſpecies are coloured floral leaves under each whirl of flowers.

CUNILA.

(Lin. Gen. Plant. 35.)

Flower of the gaping or lip kind.
Helmet or upper lip of the petal erect, flat and notched.
Four filaments; two of them without *antheræ* or tops.
Seeds four in number; oval, minute.

COLLINSONIA.

(Lin. Gen. Plant. 40.)

Flower unequal; the lower lip cut into many ſlender diviſions, reſembling hairs.
One perfect ſeed.

OBSERVATION. From the diviſions of the ſeed-bud, it ſeems probable that the natural number of ſeeds in this genus is four: yet one only attains perfection; the reſt prove abortive.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous, ſquare. Leaves ſimple, oppoſite, ſawed on their edges. Flowers terminate the ſtalks in looſe bunches or ſpikes.

MORINA.

MORINA.

(Lin. Gen. Plant. 41.)

Calix double.

Petal unequal.

A ſingle ſeed crowned by the calix of the flower.

SECONDARY CHARACTERS. Roots taper, thick and fibrous. Stem herbaceous. Leaves ſimple, ſpiny on the edges, produced by fours, and attached to the ſtem and branches without any footſtalk. Flowers produced in whirls from the angles or arm-pits of the leaves.

GENERAL REMARK.

To this diviſion of the ſecond claſs properly belong the four following ſpecies, which by Linnæus are arranged, the firſt in the third claſs; the three laſt in the firſt.

Valeriana cornucopiæ,
Boerhavia erecta,
--------- ſcandens,
--------- diandra.

ORDER II.

DIANDRIA-DIGYNIA.

Hermaphrodite plants with two ſtamina and two piſtils or ſtyles.

ANTHOXANTHUM.

(Lin. Gen. Plant. 42.)

Flower-cup huſky, oblong, conſiſting of two leaves or valves, and incloſing a ſingle flower.

Two huſky valves within the former, performing the office of petals; each valve emitting from the lower part of the back a ſharp-pointed beard, like that of oats and many other graſſes.

A ſingle ſeed.

OBSERVATION. This genus is ſufficiently diſtinguiſhed from the other graſſes by the number of its ſtamina.

SECONDARY CHARACTERS. Roots fibrous. Stem graſſy, jointed. Leaves ſimple, entire, alternate, forming below a ſort of ſheath, which nearly ſurrounds the ſtem, and is crowned at top with a ſhort membrane. Flowers terminate the ſtem in cylindrical ſpikes.

ORDER III.

DIANDRIA-TRIGYNIA.

Hermaphrodite plants with two ſtamina and three piſtils or ſtyles.

PIPER.

(Lin. Gen. Plant. 43.)

Flower-cup and petals wanting.

Seed-veſſel, a berry containing a ſingle ſeed.

SECONDARY CHARACTERS. Roots very long. Stem in ſome ſpecies ſhrubby, in ſome herbaceous. Leaves, in the greater number, alternate: in ſome ſpecies they are placed oppoſite in pairs; in others they grow by threes, and fours, or ſurround the ſtem in whirls. Flowers diſpoſed in ſpikes, which generally come out from the ſide of the branches, oppoſite to the leaves.

CLASS III.
TRIANDRIA.

THIS claſs conſiſts of hermaphrodite flowers which have three ſtamina of equal length, that are not incorporated by either extremity. It is ſubdivided, like the former, from the number of piſtils or ſtyles, into three orders.

ORDER I.

TRIANDRIA-MONOGYNIA.

Hermaphrodite plants with three ſtamina and one piſtil or ſtyle.

DIVISION THE FIRST.

Plants which have the ſeed-bud placed under the receptacle or ſeat of the flower.

VALERIANA.

(Lin. Gen. Plant. 44.)

Flower-cup ſcarce viſible.

Upper part of the petal cut into five blunt diviſions; the tube bunched at the baſe on one ſide.

A ſingle ſeed.

OBSERVATION.

OBSERVATION. This genus affords one of the ſtrongeſt objections to the Linnæan method of arrangement, and diſtribution of the genera. No leſs than ſix different ſpecies pertain to other claſſes. The diverſity too that obtains in the other parts of fructification is ſo remarkable, that it is not poſſible to give a generical deſcription that ſhall include every ſpecies. Such is the inconvenience of adopting natural genera in an artificial method.

SECONDARY CHARACTERS. Roots fleſhy, fibrous. Stem herbaceous, jointed, hollow. Leaves oppoſite, in ſome ſpecies ſimple, in ſome compound. Flowers terminate the branches in cluſters or heads reſembling an umbel.

* * IN many ſpecies of this genus, the leaves are different upon different parts of the plant. Thus in *Valeriana Pyrenaica*, the lower leaves are ſimple, the upper reſemble thoſe of trefoil. In like manner the bottom leaves of *Valeriana Phu* are ſimple and undivided; thoſe which grow upon the ſtalks are pinnated or winged.

M E L O T H R I A.

(Lin. Gen. Plant. 50.)

Flower-cup bell-ſhaped, and cut ſlightly at the brim into five parts.

Petal flat and wheel-ſhaped.

Seed-veſſel, a berry with three cells, each containing numerous ſeeds.

OBSERVATION. This genus manifeſtly pertains to the firſt order of the twenty-third claſs, *Polygamia*; ſince, by the teſtimony of Van Royen, Miller, and even Linnæus himſelf, male flowers are commixed with the hermaphrodites upon the ſame plant.

In habit and ſtructure the genus in queſtion reſembles that of *cucumis*, under which it has been placed by ſome authors.

CROCUS.

(Lin. Gen. Plant. 55.)

Upper part of the petal deeply cut into ſix equal diviſions, that are partly erect, partly expanded.

Summits of the ſtyle three in number, coloured, and ſingularly twiſted.

SECONDARY CHARACTERS. Roots bulbous. Stem wanting. Leaves radical, long, narrow, and reſembling a priſm with four prominent angles. Flowers diſpoſed in ſmall heads, which proceed immediately from the root.

IRIS.

(Lin. Gen. Plant. 59.)

Flower deeply cut into ſix diviſions, which are alternately erect and turned backwards.

Summit of the ſtyle very large, deeply divided into three leafy ſegments reſembling petals.

SECONDARY CHARACTERS. Roots tuberous or bulbous, ſpreading horizontally under the ſurface of the ground. Stem herbaceous, furniſhed with leaves, and, in the greater number of ſpecies, ſimple or undivided. Leaves ſword-ſhaped, embracing the ſtem like a ſheath. Flowers terminate the branches either ſingly or in ſpikes.

* * In a ſpecies of this genus, the *Iris aphylla* of Linnæus, the ſtem is totally devoid of leaves. *Iris tuberoſa* has quadrangular or four-cornered leaves.

MORÆA.

(Lin. Gen. Plant. 60.)

Flower compoſed of ſix petals, all of them expanded.

OBSERVATION. This genus in habit and ſtructure exactly reſembles the former.

ANTHOLYZA.

(Lin. Gen. Plant. 58.)

Flower tubular, divided into ſix irregular ſegments, one of which is bent downwards.

In habit and ſtructure this genus is nearly related to the following.

GLADIOLUS.

(Lin. Gen. Plant. 57.)

Flower deeply divided into ſix parts.

Three uppermoſt diviſions of the flower converge; three lowermoſt ſtand farther aſunder.

Stamina curving upwards, and placed immediately under the converging petals.

SECONDARY CHARACTERS. Root, a ſolid bulb. Stem herbaceous, in the greater number, undivided. Leaves ſimple, perfectly entire, ſword-ſhaped, alternate, embracing the ſtem. Flowers terminate the ſtem either ſingly or in ſmall heads.

IXIA.

(Lin. Gen. Plant. 56.)

Petals ſix in number, equal, and expanded.

Summits of the ſtyle three in number, ſimple, partly erect, partly expanded.

SECONDARY CHARACTERS. Roots fleſhy, ſpreading horizontally near the ſurface of the ground. Stem ſimple, herbaceous, in many of the ſpecies, naked or devoid of leaves. Leaves ſimple, entire, ſword-ſhaped, alternate, forming a ſheath round the ſtem at their baſe. Flowers terminate the ſtem either ſingly or in ſpikes.

DIVISION THE SECOND.

Plants which have the ſeed-bud placed upon the receptacle or ſeat of the flower.

WACHENDORFIA.

(Lin. Gen. Plant. 61.)

Flower compoſed of ſix unequal petals, the three uppermoſt of which are more erect than the others.
Seed-veſſel, a capſule with three internal diviſions or cells.

SECONDARY CHARACTERS. Roots tuberous. Stem herbaceous, emerging from the centre of the radical or bottom leaves, which are ſimple, entire, narrow, and ſpear-ſhaped. Stem-leaves ſhaped like thoſe below, but narrower, ranged alternately, half-ſurrounding the ſtem with their baſe. Flowers diſpoſed in looſe ſpikes upon footſtalks, which proceed from the joints or wings of the ſtem.

COMMELINA.

(Lin. Gen. Plant. 62.)

Flower compoſed of ſix petals; three or four of which are ſmaller, and reſemble a flower-cup in colour and duration.

Three ſingular croſs-ſhaped appearances, reſembling ſtamina, ſeated each horizontally upon its proper filament or footſtalk.

OBSERVATION. The colourleſs flower-leaves of this genus, which Linnæus denominates petals, have, by moſt authors, been deemed the flower-cup. Hence the different ſpecies have been arranged with flowers of two and three petals; with thoſe of two, when the ſmaller green flower-leaves in queſtion are four in number; with thoſe of three, when the number of green and coloured leaves is equal.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous, branched, jointed. Leaves ſimple, entire, alternate, of an oval form, ſurrounding the ſtem at their baſe. Flowers diſpoſed in ſmall heads, which proceed either from the boſom of the leaves, or terminate the ſtem.

HIPPOCRATEA.

(Lin. Gen. Plant. 54.)

Flower-cup deeply divided into five coloured ſegments.
Flower compoſed of five petals.
Capſules, three in number, ſhaped like an inverted heart; each capſule opening with two valves.

SECONDARY CHARACTERS. Roots long, fibrous. Stem herbaceous, twining. Leaves oppoſite. Flowers proceed in heads from the arm-pits of the leaves.

LOEFLINGIA.

(Lin. Gen. Plant. 52.)

Flower-cup conſiſting of five diſtinct leaves.

Flower compoſed of five petals, that are very minute.
Seed-veſſel, an undivided capſule that opens with three valves.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous. Leaves placed oppoſite in pairs, having a ſmall membranaceous ſcale on each ſide. Flowers proceed ſingly from the arm-pits of the branches. Floral leaves awl-ſhaped, indented, covering each other like tiles.

TAMARINDUS.

(Lin. Gen. Plant. 46.)

Flower-cup conſiſting of four diſtinct leaves.
Flower compoſed of three petals.
Two briſtles ſeated under the filaments of the ſtamina.
Seed-veſſel, a long, pulpy, leguminous pod.

SECONDARY CHARACTERS. Roots very long, woody, fibrous. Stem ligneous, much branched, erect. Leaves pinnated or winged; each wing conſiſting of a great many pair of lobes not terminated by an odd one. Flowers proceed from the ſides of the branches in looſe bunches or ſpikes.

CALLISIA.

(Lin. Gen. Plant. 63.)

Flower-cup compoſed of three diſtinct leaves.
Petals three in number.
Tops of the ſtamina double.
Seed-veſſel, a capſule with two cells.

OBSERVATION. The flowers of this genus greatly reſemble thoſe of *Commelina*. A compariſon of the characters will ſerve to diſcriminate them.

RUMPHIA.

(Lin. Gen. Plant. 47.)

Flower-cup ſlightly cut into three parts.
Petals three in number.
Seed-veſſel of the *drupa* or cherry kind, incloſing a nut that is internally divided into three cells.

SECONDARY CHARACTERS. Roots ligneous, branched. Stem woody. Leaves ſimple, alternate. Flowers diſpoſed in bunches or ſpikes, which proceed from the arm-pits of the leaves.

CNEORUM.

(Lin. Gen. Plant. 48.)

Flower-cup very ſmall, with three indentments.
Petals three in number, and equal.
Seed-veſſel, a dry berry, marked externally with three pretty deep furrows, which divide the ſame number of cells; each cell containing a ſingle ſeed.

SECONDARY CHARACTERS. Roots branched, ligneous. Stem ſhrubby. Leaves ſimple, entire, alternate, ſeated upon the branches without any footſtalk. Flowers proceed ſingly from the arm-pits of the leaves.

XYRIS.

(Lin. Gen. Plant. 64.)

A huſky flower-cup of two valves.
Petals three in number, equal, notched.

Seed-veſſel, a capſule with three cells.

* * THE flowers of this genus are diſpoſed in roundiſh ſpikes, and ſeparated by a number of hollow, roundiſh ſcales, which lie over each other in the manner of tiles. The leaves are ſword-ſhaped. The roots fibrous, and extend themſelves horizontally under the ſurface of the ground.

CAMOCLADIA.

(Lin. Gen. Plant. 49.)

Flower-cup deeply divided into three parts.
Petals three in number.
Style wanting.
Seed-veſſel of the cherry kind, incloſing a double-lobed membranaceous nut.

SECONDARY CHARACTERS. Roots branched. Stem woody, erect. Leaves pinnated or winged. Flowers terminating the branches in heads.

OLAX.

(Lin. Gen. Plant. 45.)

Flower-cup entire or undivided.
Petal funnel-ſhaped; the brim ſlightly cut into three.
Four ſingular appearances, ſeated upon footſtalks, in the chaps or jaws of the petal.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem woody. Leaves alternate. Flowers produced in bunches from the arm-pits of the leaves.

ORTEGIA.

ORTEGIA.

(Lin. Gen. Plant. 51.)

Flower-cup compoſed of five diſtinct leaves.
Petals wanting.
Seed-veſſel, an undivided capſule.
Seeds, numerous.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous, reſembling that of ruſh. Leaves placed oppoſite in pairs, having a ſmall membranaceous ſcale, termed *ſtipula*, on each ſide. Flowers very ſmall, terminating the ſtem either ſingly or in bunches and looſe ſpikes.

POLYCNEMUM.

(Lin. Gen. Plant. 53.)

Flower-cup compoſed of three leaves.
Petals five in number, colourleſs, and permanent like a flower-cup.
A ſingle naked ſeed.

SECONDARY CHARACTERS. Roots branched. Stem herbaceous, branched, trailing. Leaves ſimple, entire, awl-ſhaped, ranged alternately. Flowers produced ſingly in the arm-pits of the leaves, under which are ſtationed two membranaceous *ſtipulæ* or ſcales of the ſame figure with the leaves which they ſupport.

DIVISION

DIVISION THE SECOND.

Plants with graſſy flowers contained within the valves of a huſky calix.

SCHOENUS.

(Lin. Gen. Plant. 65.)

Common calix, a huſk of two valves.

Partial flower-cups conſtituted by a number of chaffy ſcales or huſks of one valve, which grow in bundles, and nearly lie over each other like tiles.

Petals wanting.

A ſingle roundiſh ſeed ſituated betwixt the chaffy huſks.

SECONDARY CHARACTERS. Roots fibrous. Stem graſſy, ſolid; in ſome ſpecies cylindrical and naked; in others, triangular and furniſhed with leaves. Leaves ſimple, perfectly entire, awl-ſhaped, forming an entire ſheath round the ſtem at their baſe, without any membranaceous crown. Flowers diſpoſed in ſmall roundiſh ſpikes or heads, which terminate the ſtem.

CYPERUS.

(Lin. Gen. Plant. 66.)

Chaffy huſks of the calix formed into a ſpike; the ſcales laid over each other like tiles on two ſides.

Petals wanting.

A ſingle, three cornered naked ſeed.

SECONDARY CHARACTERS. Roots tuberous or fibrous. Stem graſſy, ſolid; in ſome ſpecies cylindrical, in others triangular: in ſome ſpecies naked, in others cloathed with leaves. Leaves entire, ſimple, graſſy, embracing the ſtem like a ſheath, and ranged alternately. Flowers terminate the ſtem in flat, compreſſed ſpikes, which form a ſpecies of umbel.

SCIRPUS.

(Lin. Gen. Plant. 67.)

Chaffy huſks of the calix laid over each other like tiles upon all ſides.

Petals wanting.

A ſingle naked ſeed, beſet with ſhort hairs.

OBSERVATION. Theſe hairs are in ſome ſpecies connected to the top, in others to the baſe of the ſeed.

SECONDARY CHARACTERS. Roots fibrous. Stem and leaves like thoſe of the two preceding genera. Flowers diſpoſed in round ſpikes, which in ſome ſpecies are lateral, in others terminate the ſtem.

ERIOPHORUM.

(Lin. Gen. Plant. 68.)

Chaffy huſks of the calix formed into a ſpike, and laid over each other like tiles upon all ſides.

Petals wanting.

Seed, ſingle, ſurrounded by wool or down that is longer than the ſpike.

SECONDARY CHARACTERS. Roots fibrous. Stem graſſy; in the greater number cylindrical, and furniſhed with leaves,

which are ſimple, entire, and quite ſurround the ſtem at their baſe. Flowers terminate the ſtem in round ſpikes, which in the different ſpecies are more or leſs compact.

** In *Eriophorum alpinum*, the ſtem is three-cornered and devoid of leaves.

NARDUS.

(Lin. Gen. Plant. 69.)

Calix wanting.

A huſky petal of two valves, each terminated by a ſharp-pointed beard.

Seed ſingle, covered by the permanent petal.

OBSERVATION. From the permanency of the only huſky cover that is preſent, this genus might, with much greater propriety, be adjudged to want the petal. Beſides, if the calix is wanting, how can nardus be arranged under this diviſion, in which the preſence of that organ is the diſtinguiſhing character?

SECONDARY CHARACTERS. Roots fibrous. Stem graſſy, ſolid, jointed, and furniſhed with leaves which are ſimple, perfectly entire, ranged alternately, narrow and of equal breadth throughout, and form with their baſe round the ſtem a ſort of ſheath which is cleft on one ſide, and crowned at top with a pretty large membrane. Flowers terminate the ſtem in ſpikes.

LYGEUM.

(Lin. Gen. Plant. 70.)

Flower-cup, a ſheath, like that of Narciſſus, Iris, Corn-flag, and many other plants.

Two flowers ſeated upon a common ſeed-bud; each

flower compoſed of two huſky valves, that want beards.

Seed-veſſel, a nut with two internal diviſions or cells, each incloſing a ſingle ſeed.

SECONDARY CHARACTERS. Roots fibrous. Stem graſſy. Leaves alternate, forming with their baſe round the ſtem, as in the laſt genus, a ſort of ſheath which is divided on one ſide through its whole length, and ſurmounted with a long membranaceous crown. Flowers terminate the ſtem in a ſhort panicle or looſe ſpike.

ORDER II.

TRIANDRIA-DIGYNIA.

Hermaphrodite plants with three ſtamina and two piſtils or ſtyles.

THIS order contains the greater part of the numerous tribe of graſſes. It is divided as follows.

DIVISION THE FIRST.

Graſſes, having a ſingle flower, or rather a ſingle fructification, contained within a huſky calix.

BOBARTIA.

(Lin. Gen. Plant. 71.)

Huſks of the calix numerous, and laid over each other like tiles.

Huſky valves or leaves of the flower two in number, and placed above the ſeed-bud.

OBSERVATION. By theſe characters, particularly the ſituation of the flower with reſpect to the ſeed-bud, the genus in queſtion is eſſentially diſtinguiſhed from all the genera of this order.

** IN habit and ſtructure the genus *Bobartia* is little different from that of *Schoenus*, one ſpecies of which it greatly reſembles.

PANICUM.

(Lin. Gen. Plant. 76.)

Huſky valves of the calix three in number; one of them very little, and placed at the back of one of the other two.

SECONDARY CHARACTERS. Roots creeping, in the different ſpecies perpendicular and horizontal. Stem jointed and producing runners. Sheath of the graſſy leaves cleft on one ſide, wanting a membranaceous crown, in ſome ſpecies crowned with hairs. Flowers terminate the ſtem in compact or looſe ſpikes.

CORNUCOPIÆ.

(Lin. Gen. Plant. 72.)

A common flower-cup of one piece, that is funnel-ſhaped, very large, notched on the brim, and incloſes many flowers.

Huſky valves of the proper calix two in number, ſupporting (in the terms of the diviſion) a ſingle fructification.

Flower conſiſting of one huſky valve.

OBSERVATION. The flowers of this genus are not eaſily to be diſtinguiſhed from thoſe of *Alopecurus*.

SECONDARY CHARACTERS. Sheath of the leaves divided on one ſide through its whole length, and crowned at top with a pretty large membrane. Flowers collected in heads within a common cover, and placed upon footſtalks which emerge from the boſom or ſheath of the leaves.

* * IN one ſpecies, the huſks of the flower are unarmed; in the other, they are furniſhed with beards.

ARISTIDA.

(Lin. Gen. Plant. 94.)

Huſks of the calix two in number.

Flower conſiſting of one huſky valve terminated by three beards that are expanded and nearly equal.

SECONDARY CHARACTERS. Sheath of the leaves cleft on one ſide and crowned with hairs. Flowers terminate the ſtem in looſe, cylindrical ſpikes.

* * In *Ariſtida plumoſa*, the intermediate beard is longer than the reſt, and covered with a ſort of pubeſcence reſembling wool.

ALOPECURUS.

(Lin. Gen. Plant. 78.)

Huſks of the calix two in number.

Flower conſiſting of one huſky valve, in the back of which, towards the baſe, is inſerted a long *ariſta* or beard.

SECONDARY CHARACTERS. Roots fibrous, in one ſpecies bulbous. Sheath of the leaves cleft on one ſide, and crowned with a ſhort membrane. Flowers terminate the ſtem in a compact

compact cylindrical ſpike. Near the ſheath of the leaves, in one ſpecies, the *Alopecurus Monſpelienſis* of Linnæus, is ſtationed a broad, rigid membranaceous *ſtipula* or ſcale.

** In one or two ſpecies of this genus, the huſk of the flower is unarmed: in the Montpelier ſpecies juſt mentioned, from the huſks of the calix, a little below the apex or tip, are emitted beards three times longer than the valves which produce them. The beard of the flower in the ſame ſpecies is very ſhort. *Alopecuris hordeiformis*, a native of India, has the flower compoſed of two huſky valves, and the huſky flower-cups ſurrounded with a great number of briſtly hairs like beards, which are much longer than the flowers.

PHLEUM.

(Lin. Gen. Plant. 77.)

Huſks of the calix two in number, of equal breadth throughout, flattened on the ſides, and pointed.

Flower conſiſting of two huſky, unarmed, ſhorter valves, which, together with the calix, involve a ſingle ſeed.

SECONDARY CHARACTERS. Roots fibrous, in one ſpecies bulbous. Sheath of the leaves cleft on one ſide, and crowned at top by a pretty large membrane. Flowers terminate the ſtem, as in the former ſpecies, in compact cylindrical ſpikes.

PHALARIS.

(Lin. Gen. Plant. 74.)

Huſky valves of the calix two in number, equal, ridged or keel-ſhaped on the back, and involving the flower.

SECONDARY CHARACTERS. Roots bulbous or fibrous. Sheath of the leaves divided on one ſide, and crowned with a pretty large membrane. Flowers terminate the ſtem in cylindrical ſpikes, which in ſome ſpecies are looſer, in others more compact. Neither calix nor petals are furniſhed with beards.

PASPALUM.

(Lin. Gen. Plant. 75.)

Huſks of the calix two in number, round.

Flower compoſed of two huſky valves, of the ſame ſize and figure with thoſe of the calix.

Stamina, in ſhape reſembling a painter's pencil.

SECONDARY CHARACTERS. Sheath of the leaves cleft on one ſide, and ſurmounted by a pretty large membranaceous crown. Flowers diſpoſed in ſpikes which terminate the graſſy ſtem. Neither of the covers emits beards.

MILIUM.

(Lin. Gen. Plant. 79.)

Huſks of the calix two in number, inflated, and larger than thoſe of the flower, which are very ſhort.

Summits of the ſtyle pencil-ſhaped.

SECONDARY CHARACTERS. Sheath of the leaves crowned with hairs. Flowers terminating the ſtem in looſe ſpikes.

** THE flowers in ſome ſpecies are armed with beards, in others unarmed.

AGROSTIS.

AGROSTIS.

(Lin. Gen. Plant. 80.)

Huſks of the calix two in number, ſharp-pointed, and leſs than thoſe of the flower.

Summits of the ſtyle briſtly.

SECONDARY CHARACTERS. Sheath of the leaves crowned with a ſhort membrane. Flowers terminate the ſtem in panicles or ſpikes.

* * THE huſks in ſome ſpecies are armed; in others defenceleſs.

DACTYLIS.

(Lin. Gen. Plant. 86.)

Huſks of the calix two in number; one of the valves longer than the flower, compreſſed, with a ridge along the back.

SECONDARY CHARACTERS. Sheath of the leaves crowned with a pretty large membrane. Flowers terminate the ſtem in compact or looſe ſpikes.

* * IN a ſpecies of this genus, the *Dactylis glomerata* of Linnæus, four flowers are contained within the huſky calix. In ſtrict propriety, therefore, that ſpecies ought to be referred to ſome other genus: it certainly does not fall under the preſent diviſion.

STIPA.

(Lin. Gen. Plant. 90.)

Huſks of the calix two in number.

Outer huſk of the flower terminated by a very long twiſted beard that is jointed at the baſe.

SECONDARY CHARACTERS. Sheath of the leaves crowned with a pretty large membrane. Flowers terminate the ſtem in cylindrical ſpikes.

LAGURUS.

(Lin. Gen. Plant. 92.)

Huſks of the calix two in number, each terminated with a hairy or briſtly beard.

Flower compoſed of two huſky valves: the outermoſt terminated with two ſmall, erect, beards, and emitting from the middle of its back a third beard, that riſes betwixt the other two, and is twiſted backwards.

SECONDARY CHARACTERS. Sheath of the leaves crowned with a ſhort membrane. Flowers diſpoſed in cylindrical ſpikes which terminate the ſtem.

SACCHARUM.

(Lin. Gen. Plant. 73.)

Calix wanting; in its place a long downy pubeſcence reſembling wool, ſupporting a ſingle fructification.

Flower compoſed of two huſky valves.

SECONDARY CHARACTERS. Stem jointed. Leaves ranged alternately, embrace the ſtem with their baſe; the ſheath cleft on one ſide and crowned with hairs. Flowers terminate the ſtem in looſe ſpikes.

** IN one ſpecies, the huſks of the flower are beardleſs; in the other, they are armed with beards.

GENERAL

GENERAL REMARK.

To this diviſion of the ſecond order ought to have been referred three ſpecies of reed, the *Arundo epigejos*, *Calamagroſtis*, and *arenaria* of Linnæus, which have a ſingle fructification contained within a huſky calix. The genus *Arundo* ranks in the third Diviſion.

DIVISION THE SECOND.

Graſſes, having two flowers or fructifications contained within a huſky calix.

MELICA.

(Lin. Gen. Plant. 82.)

Huſks of the calix two in number.

Rudiment of a third flower interjected betwixt the other two.

SECONDARY CHARACTERS. Sheath of the leaves entire, and crowned with two membranes, one on each ſide of the ſtem. Flowers diſpoſed in compact or looſe ſpikes, which terminate the ſtalk.

AIRA.

(Lin. Gen. Plant. 81.)

Huſks of the calix two in number.

Flowers two in number, without the rudiment of a third.

OBSERVATION. By the want of this rudiment, the genus in queſtion is eſſentially diſtinguiſhed from the laſt.

SECONDARY CHARACTERS. Sheath of the leaves divided on one ſide, and crowned with a pretty long membrane. Flowers diſpoſed in ſpikes that terminate the ſtem.

** SOME of the ſpecies have the huſks armed with beards; in others, they are beardleſs.

GENERAL REMARK.

UNDER this diviſion of the third claſs ought to be arranged the *tripſacum hermaphroditum* of Linnæus, which, although furniſhed, as the name imports, with hermaphrodite flowers, is made to rank in the twenty-firſt claſs, that of plants with male and female flowers upon the ſame individual.

DIVISION THE THIRD.

Graſſes having many flowers or fructifications contained within a huſky calix, and diſpoſed in looſe ſcattered heads.

UNIOLA.

(Lin. Gen. Plant. 85.)

Huſks of the calix numerous, laid over each other like tiles on two ſides, compreſſed, with a ridge along the back.

Spike of flowers ſupported by the calix, oval or egg-ſhaped.

BRIZA.

(Lin. Gen. Plant. 84.)

Huſks of the calix two in number.

Flower heart-ſhaped; the valves unequal and inflated.

** IN habit and ſtructure, the two preceding genera are nearly allied to the following.

POA.

(Lin. Gen. Plant. 83.)

Huſks of the calix two in number.

Flower compoſed of two valves, that are ſomewhat ſharp-pointed, and tranſparently ſcaly on the edges.

SECONDARY CHARACTERS. Sheath of the leaves cleft on one ſide, and crowned with a pretty large membrane. Flowers terminate the ſtem in diffuſe ſpikes.

** BOTH calix and petals in this genus are beardleſs. The ſmall ſpikes of which the panicle or large head of flowers is compoſed, are of an oval form. In *Briza* they are heart-ſhaped.

FESTUCA.

(Lin. Gen. Plant. 88.)

Huſks of the calix two in number.

Flower compoſed of two valves; the lower terminated in a ſharp point.

Spikes of flowers oblong.

BROMUS.

(Lin. Gen. Plant. 89.)

Huſks of the calix two in number.

Lower huſk of the flower emitting a beard from below its tip or ſummit.

Spikes of flowers oblong.

** IN habit and ſtructure, the two preceding genera are nearly allied to each other, and to the genus *Poa*, whoſe ſecondary characters are delineated above.

AVENA.

(Lin. Gen. Plant. 91.)

Huſks of the calix two in number.

Flower compoſed of two husky leaves or valves; the lower emitting from its back a beard that is jointed, and twiſted into a ſpiral form.

OBSERVATION. In ſome ſpecies of this genus, particularly in *Avena Sibirica, elatior, ſtipiformis,* and *Penſylvanica* of Linnæus, the huſky calix is not common to many flowers, but ſupports one only, as in the firſt-mentioned ſpecies, or two, as in the three others. Thoſe ſpecies, therefore, not poſſeſſing the characters of the diviſion under which they arrange, ought to be transferred to the firſt and ſecond diviſions, whoſe characters they reſpectively bear. *Avena elatior* has one of its flowers hermaphrodite, and beardleſs; the other male and bearded.

SECONDARY CHARACTERS. Roots bulbous or fibrous. Stem jointed. Sheath of the leaves cleft on one ſide, and crowned at top with a ſhort membrane.

ARUNDO.

(Lin. Gen. Plant. 93.)

Husks of the calix two in number.

Valves of the flower two in number; beardleſs, ſurrounded at the baſe with a long downy pubeſcence, reſembling wool.

OBSERVATION. The flowers of this genus greatly reſemble thoſe of *Saccharum,* but may be diſtinguiſhed by the preſence of

of the huſky calix, which in the laſt-mentioned genus is ſupplied by the woolly pubeſcence that environs the flower.

SECONDARY CHARACTERS. Roots jointed, bulbous, ſolid, knotty, and ſpread horizontally under the ſurface of the ground. Stem jointed, hollow. Sheath of the leaves divided on one ſide, and crowned with hairs or with a ſhort membrane.

GENERAL REMARK.

To this diviſion, as was formerly obſerved, ought to be transferred the *Dactylis glomerata* of Linnæus, which has four flowers contained within the huſky calix.

DIVISION THE FOURTH.

Graſſes having one, two or many fructifications contained within a huſky calix, and diſpoſed in cloſe, compact ſpikes upon the indentments of a lengthened receptacle.

SECALE.

(Lin. Gen. Plant. 97.)

Calix ſingle or ſolitary.

Husks of the calix two in number, placed oppoſite, containing two flowers, which are ſeated upon the receptacle without any footſtalk.

OBSERVATION. Betwixt two larger flowers that are ſeated immediately upon the receptacle, is frequently ſtationed a third flower which ſtands upon a footſtalk.

SECONDARY CHARACTERS. Roots fibrous, ſpreading horizontally under the ſurface of the ground. Stem jointed. Sheath of the leaves cylindrical, crowned with a ſhort membrane, and accompanied with two lateral appendages or ears, which bend backwards, and embrace the ſtem ſemicircularly.

TRITICUM.

(Lin. Gen. Plant. 99.)

Calix ſingle or ſolitary.

Husks of the calix two in number, placed oppoſite, containing many flowers, which are ſeated upon the receptacle without any footſtalk.

OBSERVATION. The outer valve or huſk of the flower is in ſome ſpecies bearded, in others beardleſs. The number of flowers contained within the huſks of the common calix is three, four or five. One of the intermediate flowers is frequently male or barren. In *Triticum polonicum*, the calix ſupports two flowers only.

SECONDARY CHARACTERS. Roots fibrous. Stem jointed. Sheath of the leaves, as in the laſt genus.

HORDEUM.

(Lin. Gen. Plant. 98.)

Flower-cups placed by threes.

Husky valves of the calix two in number, lateral, (not oppoſite) containing a ſingle flower that is ſeated immediately upon the receptacle.

OBSERVATION. In this genus, ſix huſks are common to three flowers. In ſome ſpecies, all the three are hermaphrodite, and conſequently fertile; in others, particularly *Hordeum diſtichon*, *Zeocriton*, *nodoſcum*, and *murinum*, the lateral flowers are male; the intermediate flower only is hermaphrodite and fertile.

SECONDARY

SECONDARY CHARACTERS. Roots fibrous, in one ſpecies bulbous. Stem and leaves as in the two foregoing genera.

ELYMUS.

(Lin. Gen. Plant. 96.)

Flower-cups placed by twos or threes.

Huſky valves of the calix two in number, lateral, (not oppoſite) containing or ſupporting many flowers.

OBSERVATION. In *Elymus europæus, arenarius and Caput Meduſæ*, the ſmall ſpike ſupported by the huſky calix contains only two flowers.

SECONDARY CHARACTERS. Roots fibrous, ſpreading horizontally under the ſurface of the ground. Stem and leaves as in the laſt genus.

LOLIUM.

(Lin. Gen. Plant. 95.)

Calix ſingle or ſolitary, conſiſting of one leaf or valve, that contains many flowers; the ſpikes ranged alternately along both ſides of a common receptacle.

OBSERVATION. The ſmall ſpikes ſupported by the ſingle huſk of the calix are placed in the ſame plane with the ſtem, which hence performs the functions of another valve, and ſupplies the place of that which is wanting. Adanſon affirms, that two equal, oppoſite huſks are generally obſerved under that aggregate which terminates the large or compound ſpike.

** In two ſpecies, the flowers are beardleſs; in the third, they are bearded.

CYNOSURUS.

(Lin. Gen. Plant. 87.)

Huſks of the calix two in number, containing many flowers.

Proper receptacle of each partial ſpike of flowers ſtationed on one ſide only of the ſtem, and guarded at bottom with floral leaves, which in ſome ſpecies are entire, but in the greater number are deeply jagged.

OBSERVATION. In *Cynoſurus echinatus*, and *Ægyptius*, the huſks of the calix contain two flowers only.

SECONDARY CHARACTERS. Roots fibrous. Stem jointed. Sheath of the leaves cleft on one ſide, and crowned with a pretty long membrane, unaccompanied with lateral appendages.

** THE diviſions of the floral leaves in this genus commonly reſemble the teeth of a comb.

GENERAL REMARK.

Hordeum and *Secale* agree with the genera of the firſt and ſecond diviſions in the number of flowers ſupported by the huſky calix, but are diſtinguiſhed from them by the diſpoſition of their flowers in cloſe ſquat ſpikes along both ſides of a lengthened receptacle.

ORDER

ORDER III.

TRIANDRIA-TRIGYNIA.

Hermaphrodite plants with three ſtamina and three piſtils or ſtyles.

DIVISION THE FIRST.

Plants having the ſeed-bud placed upon the receptacle or ſeat of the flower.

HOLOSTEUM.

(Lin. Gen. Plant. 104.)

Flower-cup conſiſting of five diſtinct leaves.
Petals five in number.
Seed-veſſel, an undivided capſule, that is nearly cylindrical, and ſplits at top by three openings or valves.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous, cylindrical. Leaves placed oppoſite in pairs. Flowers diſpoſed in heads or umbels which terminate the branches.

POLYCARPON.

(Lin. Gen. Plant. 105.)

Flower-cup conſiſting of five diſtinct leaves.
Petals five in number, very ſhort, oval and permanent.
Seed-veſſel, an undivided capſule with three openings or valves.

SECONDARY CHARACTERS. Roots branched. Stem herbaceous, branched. Leaves ſimple, perfectly entire, without footſtalks, growing in fours round the ſtem. Flowers terminate the ſtem in panicles or looſe heads, whoſe diviſions and ſubdiviſions are always in two. Betwixt the proper footſtalks of the flowers are interjected two *ſtipulæ*, or ſcaly leaves that ſtand oppoſite.

LECHEA.

(Lin. Gen. Plant. 109.)

Flower-cup compoſed of three diſtinct leaves.
Petals three in number, of equal breadth throughout.
Seed-veſſel, a three-cornered capſule, with three cells, and the ſame number of external and internal valves; the latter ſerving to divide, or ſeparate the cells.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous and cylindrical. Leaves oppoſite. Flowers diſpoſed in looſe ſpikes or heads.

ERIOCAULON.

(Lin. Gen. Plant. 100.)

Flower-cup globular and common to many flowers: the ſcales or leaves laid over each other like tiles.
Petals of each flower three in number, and equal.
Stamina ſeated upon the ſeed-bud.
A ſingle ſeed, crowned with the flower.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem graſſy, angular. Leaves long, ſword-ſhaped. Flowers terminate the ſtem in globular aggregates or heads.

MONTIA.

(Lin. Gen. Plant. 101.)

Flower-cup compoſed of two diſtinct leaves.
Flower conſiſting of one irregular petal.
Seed-veſſel, an undivided capſule, with three valves or openings, incloſing the ſame number of ſeeds.

OBSERVATION. The flower-cup in this genus has frequently three leaves: in which caſe, the number of ſtamina generally varies from three to five.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous, branched, ſtriking root, cylindrical. Leaves ſimple, entire, placed oppoſite in pairs, without footſtalks. Flowers ſeated upon footſtalks which proceed ſingly, or in greater number, from the arm-pits of the leaves.

MOLLUGO.

(Lin. Gen. Plant. 106.)

Flower-cup conſiſting of five leaves.
Petals or flower-leaves wanting.
Seed-veſſel, a capſule with three cells, and the ſame number of valves or openings.

SECONDARY CHARACTERS. Roots branched. Stem herbaceous, branched. Leaves ſimple, entire, produced in whirls round the ſtem. Flowers ſeated upon footſtalks, which proceed from the arm-pits of the leaves.

* * IN one ſpecies of this genus, the leaves grow oppoſite in pairs.

MINUARTIA.

MINUARTIA.

(Lin. Gen. Plant. 107.)

Flower-cup compoſed of five diſtinct leaves.
Petals wanting.
Seed-veſſel, an undivided capſule with three openings or valves, containing many ſeeds.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous. Leaves ſimple, entire, narrow, oppoſite. Flowers terminate the ſtem in heads, or proceed from the arm-pits of the leaves and branches. Floral leaves under the flowers, which, in ſome ſpecies, overtop them; in others, are overtopped by them.

QUERIA.

(Lin. Gen. Plant. 108.)

Flower-cup compoſed of five diſtinct leaves.
Petals wanting.
Seed-veſſel, an undivided capſule with three valves or openings, incloſing a ſingle ſeed.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous. Leaves placed oppoſite in pairs. Flowers proceed ſingly or in heads from the arm-pits of the branches.

KOENIGIA.

(Lin. Mantiſſa. Plant. 1241.)

Flower-cup compoſed of three diſtinct leaves.
Petals wanting.
Seed ſingle, naked, egg-ſhaped.

SECONDARY CHARACTERS. Roots fibrous and branched. Stem herbaceous, furniſhed with a very few ſpreading branches that grow oppoſite to the leaves. Leaves ſimple, entire, placed upon a ſhort footſtalk, ſomewhat ſucculent, ſhaped like an inverted egg, ranged alternately, except towards the top of the ſtem, where they are produced in fours. Flowers collected on the top of the ſtalk, and ſeparated from each other by floral leaves of a membranaceous conſiſtence. On the inſide of the leaves is ſtationed a ſingle, bell-ſhaped, permanent *ſtipula*, or ſcaly leaf, which forms a ſheath round the ſtem with its baſe, as in rhubarb and perſicaria.

** THIS genus in habit and external appearance reſembles *Polycarpon*.

TRIPLARIS.

(Lin. Gen. Plant. 103.)

Flower-cup very large, deeply divided into three parts.

Petals wanting.

Seed, a three-cornered nut placed within the baſe or tube of the permanent expanded flower-cup.

SECONDARY CHARACTERS. Roots branched, woody. Stem ligneous. Leaves alternate, entire, ſtanding upon footſtalks. Flowers terminate the ſtem in erect pyramidal ſpikes. Floral leaves ſmall, egg-ſhaped, pointed, hairy.

GENERAL REMARK.

To this diviſion of the third claſs may be referred the *Tillæa muſcoſa* of Linnæus, which moſt commonly bears three ſtamina and three piſtils or ſtyles. The genus *Tillæa* ranks in the fourth order of the fourth claſs, whoſe characteriſtics are four ſtamina, and the ſame number of piſtils.

DIVISION THE SECOND.

Plants having the ſeed-bud placed under the receptacle or ſeat of the flower.

PROSERPINACA.

(Lin. Gen. Plant. 102.)

Flower-cup deeply divided into three parts.

Petals wanting.

A ſingle, three-cornered ſeed, divided into three cavities or cells.

SECONDARY CHARACTERS. Roots creeping. Stem herbaceous, nearly cylindrical. Leaves ſimple, alternate, lancet-ſhaped, ſawed on the edges, with footſtalks: the lower leaves, which are immerſed in the water, deeply jagged. Flowers proceed ſingly from the arm-pits of the leaves.

CLASS

CLASS IV.

TETRANDRIA.

THIS claſs comprehends hermaphrodite plants which have four equal ſtamina that are not connected either by the filaments or ſummits. It is ſubdivided into three orders, diſtinguiſhed, like thoſe of the former claſſes, from the number of piſtils, ſtyles or female organs.

ORDER I.

TETRANDRIA-MONOGYNIA.

Hermaphrodite plants with four ſtamina and one piſtil or ſtyle.

DIVISION THE FIRST.

Compleat flowers, having one or two petals, a ſingle naked ſeed, and the ſeed-bud placed upon the receptacle or ſeat of the flower.

** By compleat flowers I mean ſuch as are furniſhed with both flower-cup and petals.

LEUCADENDRON.

(Lin. Gen. Plant. 110.)

Flower-cup common to many florets.
Proper flower-cup wanting.

Petals two in number; the lower cut ſlightly at the brim into three.
Summits of the ſtamina nearly united.
A ſingle ſeed, ſurmounted with a hairy crown.
Stamina very ſhort, not projecting beyond the petals.

OBSERVATION. In two ſpecies of this genus, the *Leucadendron racemoſum* and *pinifolium* of Linnæus, the flower-cup is not common to many florets, but ſupports a ſingle fructification. The laſt-mentioned ſpecies has four diſtinct petals.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem woody. Leaves alternate, evergreen, with or without footſtalks. Flowers collected into heads within a common calix at the extremity of the branches.

** THE union of the *antheræ* or ſummits of the ſtamina is a ſtriking character, and eſſentially approximates the plants of this genus to thoſe of the claſs *Syngeneſia*, which they greatly reſemble in habit and external form.

P R O T E A.

(Lin. Gen. Plant. 111.)

Flower-cup common to many florets.
Proper flower-cup wanting.
Flower conſiſting of one petal, that is cut at top into four equal diviſions.
A ſingle ſeed, not ſurmounted with a hairy or downy crown.
Common receptacle, or ſeat of the flowers, beſet with chaffy ſcales.

** IN habit and ſtructure this genus reſembles the preceding.

GLOBULARIA.

(Lin. Gen. Plant. 112.)

Flower-cup common to many florets or partial flowers.
Proper flower-cup conſiſting of one tubular leaf.
A ſingle petal, deeply divided into five irregular or unequal diviſions.
Seed, not ſurmounted with a hairy or downy crown.
Common receptacle or ſeat of the flowers chaffy.

SECONDARY CHARACTERS. Roots ſimple or branched, and fibrous. Stem herbaceous or ſhrubby, ſimple or branched; in ſome ſpecies leafy, in others naked or devoid of leaves. Radical or bottom leaves large, numerous. Stem-leaves ſmall, narrow, entire, without footſtalks, and ranged alternately. Flowers terminate the branches in globular heads;---hence the name by which the genus in queſtion is diſtinguiſhed.

DIVISION THE SECOND.

Compleat flowers, having one petal, a ſingle naked ſeed, and the ſeed-bud placed below the receptacle or ſeat of the flower.

CEPHALANTHUS.

(Lin. Gen. Plant. 113.)

Common flower-cup wanting.
Proper flower-cup compoſed of one funnel-ſhaped leaf.
Common receptacle or ſeat of the flowers globular, and beſet with ſoft diſtinct hairs.
A ſingle ſeed, covered with down or wool.

SECONDARY CHARACTERS. Roots branched. Stem ſhrubby; the branches oppoſite. Leaves placed oppoſite in pairs, or by threes round the ſtem and branches. Flowers terminate the branches in globular heads.

DIPSACUS.

(Lin. Gen. Plant. 114.)

Common flower-cup of many leaves.
Proper flower-cup very ſmall.
Common receptacle or ſeat of the flowers conical, and beſet with chaffy ſcales.
A ſingle pillar-ſhaped ſeed, crowned with the ſmall permanent calix.

SECONDARY CHARACTERS. Roots ſpindle-ſhaped. Stem herbaceous, angular, branched. Leaves ſimple, oppoſite, united at their baſe ſo as to have the appearance of one leaf, entire or jagged. Flowers terminate the ſtem in conical heads. Stem and leaves prickly.

** IN *Dipſacus piloſus*, the leaves ſtand upon footſtalks.

SCABIOSA.

(Lin. Gen. Plant. 115.)

Common flower-cup compoſed of many leaves.
Proper flower-cup double.
Common receptacle or ſeat of the flowers convex, and nearly chaffy.
A ſingle ſeed, crowned with the proper flower-cups.

OBSERVATION. The crown of the ſeeds varies in the different ſpecies.

SECONDARY CHARACTERS. Roots fibrous or branched. Stem herbaceous or ſhrubby; ſimple or branched. Leaves oppoſite; the lower furniſhed with footſtalks, the upper ſeated immediately upon the ſtem and embracing it: in ſome ſpecies ſimple, and entire or jagged; in others pinnated or winged; each leaf compoſed of many lobes, and terminated with an odd one. Flowers collected in an aggregate or head at the extremity of the ſtem and branches.

* * THE leaves of the common calix in the Tranſylvanian and Syrian ſpecies of ſcabious run out into a prickly beard. In the latter ſpecies, ſhort prickles are obſerved upon the upper part of the ſtem, which is forked, that is, has its branches divided and ſubdivided in two.

KNAUTIA.

(Lin. Gen. Plant. 116.)

Common calix ſimple, oblong, tubular, containing a ſingle row or ſeries of florets, which are generally five in number.

Proper calix ſingle.

Florets irregular or unequally divided.

Common receptacle or ſeat of the flowers flat and naked, or devoid of hairs and chaff.

A ſingle ſeed; the *apex* or top hairy.

SECONDARY CHARACTERS. Roots branched. Stem herbaceous, branched. Leaves ſimple, perfectly entire, oppoſite, without footſtalks. Flowers terminate the branches in ſmall aggregates or heads.

ALLIONIA.

ALLIONIA.

(Lin. Gen. Plant. 117.)

Common calix ſimple, oblong, ſupporting three florets.

Proper calix wanting.

Florets irregular, or unequally divided.

Receptacle or ſeat of the flowers naked.

A ſingle naked ſeed.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous, branched. Leaves ſimple, oppoſite, without footſtalks. Flowers terminate the branches in ſmall aggregates or heads.

GENERAL REMARK.

UNDER this diviſion of the fourth claſs ought to be arranged two ſpecies of valerian, the *Valeriana ſibirica* and *ſupina* of Linnæus, which, although furniſhed with four ſtamina, are made to rank with the other valerians in the preceding claſs.

DIVISION THE THIRD.

Compleat flowers, having one petal, a ſingle covered fruit, and the ſeed-bud placed upon the receptacle or ſeat of the flower.

AQUARTIA.

(Lin. Gen. Plant. 136.)

Flower-cup bell-ſhaped; the brim generally cut into four.

Petal plain and wheel-ſhaped; the diviſions four in number, of equal breadth.

Seed-veſſel, a berry, containing many ſeeds.

SECONDARY CHARACTERS. Roots branched. Stem ſhrubby. Leaves egg-ſhaped, ſtanding upon footſtalks, and ranged alternately.

* * THERE is only one ſpecies of this genus. It is a native of South America, a prickly plant, but unarmed above.

CALLICARPA.

(Lin. Gen. Plant. 135.)

Flower-cup bell-ſhaped: the brim cut ſlightly into four.

Petal tubular: the diviſions four in number.

Seed-veſſel, a berry containing four ſeeds.

SECONDARY CHARACTERS. Roots branched. Stem ſhrubby. Leaves ſimple, ſtanding on ſhort footſtalks, oppoſite. Flowers grow in whirls round the branches, which when young are downy.

SCOPARIA.

(Lin. Gen. Plant. 143.)

Flower-cup deeply divided into four.

Petal wheel-ſhaped; the diviſions four in number.

Seed-veſſel, an undivided capſule, with two valves or openings, containing ſeveral ſeeds.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem ſhrubby, angular. Leaves placed oppoſite by threes or fours. Flowers proceed ſingly or by twos from the ſide of the branches, and either ſtand upon footſtalks, or are ſeated immediately upon the ſtalk.

CENTUNCULUS.

CENTUNCULUS.

(Lin. Gen. Plant. 145.)

Flower-cup deeply cut into four.

Petal wheel-ſhaped or expanded; the diviſions four in number.

Stamina ſhort.

Seed-veſſel, an undivided capſule, opening tranſverſely or horizontally like a ſnuff-box, and incloſing ſeveral ſeeds.

SECONDARY CHARACTERS, Roots branched and fibrous. Stem herbaceous, cylindrical. Leaves alternate. Flowers proceed ſingly from the angles or arm-pits of the leaves.

PLANTAGO.

(Lin. Gen. Plant. 142.)

Flower-cup deeply ſplit into four parts.

Upper part of the petal cut into four diviſions, which are turned backwards.

Stamina very long.

Seed-veſſel, a capſule with two cavities or cells, opening horizontally like a ſnuff-box.

SECONDARY CHARACTERS. Roots fibrous or branched. Stem herbaceous or ſhrubby; in ſome ſpecies furniſhed with leaves, but naked in the greater number. Radical leaves ſimple, entire or jagged. Stem-leaves oppoſite, and perfectly entire. Flowers terminate the ſtem or branches in ſpikes. A ſingle floral leaf placed at the baſe of each flower.

POLYPREMUM.

(Lin. Gen. Plant. 137.)

Flower-cup of four leaves.

Petal wheel-ſhaped; the diviſions four in number, in form reſembling an inverted heart.

Seed-veſſel, a capſule that is notched, compreſſed at top, and divided into two cavities or cells.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem herbaceous, procumbent. Leaves ſimple, oppoſite, ſtanding upon footſtalks. Flowers proceed ſingly from the arm-pits of the leaves.

BUDDLEJA.

(Lin. Gen. Plant. 140.)

Flower-cup cut ſlightly into four.

Petal bell-ſhaped; the indentments of the brim four in number.

Stamina inſerted into the petal at its indentments or diviſions.

Seed-veſſel, a capſule, marked with a double longitudinal furrow, and divided into two cells, each incloſing a great number of very ſmall ſeeds.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem woody; the branches oppoſite. Leaves ſimple, oppoſite. Flowers terminate the branches in looſe or compact ſpikes.

EXACUM.

(Lin. Gen. Plant. 141.)

Flower-cup of four leaves.

Petal nearly bell-ſhaped; brim deeply divided into four; the tube ſpherical or globular.

Seed-veſſel, a capſule marked on each ſide with a longitudinal furrow, compreſſed, ſplitting at top, and divided internally into two cavities or cells, each containing numerous ſeeds.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous, branched. Leaves oppoſite. Flowers proceed ſingly from the arm-pits of the branches, and either ſtand upon footſtalks, or are ſeated immediately upon the ſtem.

PENÆA.

(Lin. Gen. Plant. 138.)

Flower-cup of two leaves.

Petal bell-ſhaped.

Style quadrangular.

Seed-veſſel, a four cornered capſule, with four cells, the ſame number of openings or valves, and eight ſeeds.

SECONDARY CHARACTERS. Roots branched and garniſhed with fibres. Stem ſhrubby. Leaves ſimple, ranged alternately. Flowers diſpoſed in heads which terminate the branches.

BLÆRIA.

(Lin. Gen. Plant. 139.)

Flower-cup deeply cut into four ſegments.

Flower nearly bell-ſhaped: diviſions of the brim four in number.

Stamina inſerted into the receptacle or ſeat of the flower.

Seed-veſſel, a four-cornered capſule, that is divided into four cavities, incloſing ſeveral ſeeds, and ſplits at the angles.

SECONDARY CHARACTERS. Roots branched and fibrous. Stem ſhrubby. Leaves placed oppoſite in pairs, or by fours round the ſtem and branches, upon ſhort footſtalks. Flowers in one ſpecies terminate the branches in aggregates or heads; in the other, they are ſcattered, minute, and ſhorter than the leaves.

** THIS genus is not without caution to be diſtinguiſhed from the heaths.

GENERAL REMARK.

To this diviſion of the fourth claſs properly belong the *Swertia corniculata* and *dichotoma* of Linnæus, as likewiſe five ſpecies of gentian, the *Gentiana campeſtris, ciliata, Cruciata, ſeſſilis*, and *filiformis*, of our author: all which, although furniſhed with only four ſtamina, are made to rank with their reſpective genera in the fifth claſs.

DIVISION THE FOURTH.

Compleat flowers, having one petal, a ſingle covered fruit, and the ſeed-bud placed under the receptacle or ſeat of the flower.

FUCHSIA.

(Lin. Gen. Plant. 128.)

Flower-cup entire or undivided.

Petal funnel-ſhaped; the diviſions of the brim eight in number.

Seed-veſſel, a berry with four cavities or cells, each incloſing ſeveral ſeeds.

SECONDARY CHARACTERS. Roots ramified and fibrous. Stem herbaceous, having few or no branches. Leaves lancet-ſhaped, without footſtalks, growing by threes round the ſtem. Flowers terminate the ſtem in erect cluſters.

PAVETTA.

(Lin. Gen. Plant. 132.)

Flower-cup bell-ſhaped, with four indentments.

Petal tubular or funnel-ſhaped.

Summit of the ſtyle oblique or crooked.

Seed-veſſel, a berry incloſing a ſingle ſeed.

SECONDARY CHARACTERS. Roots branched, ligneous. Stem woody. Leaves ſimple, placed oppoſite in pairs. Flowers terminate the branches or proceed from the armpits of the leaves in cluſters like thoſe of ivy-berries, which riſe to an equal height, and are ſeated upon a long, ſlender footſtalk.

IXORA.

(Lin. Gen. Plant. 131.)

Flower-cup deeply divided into four.

Petal long, tubular or funnel-ſhaped.

Stamina overtopping the chaps or jaws of the petal.

Seed-veſſel, a berry with two cells, each containing the ſame number of ſeeds.

SECONDARY CHARACTERS. Roots branched. Stem woody. Leaves ſimple, ſtand oppoſite in pairs, or are produced by

threes and fours round the branches, which are terminated by cluſters, bundles or looſe ſpikes of flowers. A ſingle *ſtipula* or ſubſidiary leaf ſtationed betwixt the oppoſite leaves.

PETESIA.

(Lin. Gen. Plant. 133.)

Indentments of the flower-cup four in number.
Petal tubular or bell-ſhaped.
Summit of the ſtyle divided into two.
Seed-veſſel, a berry with two cavities, each containing ſeveral ſeeds.

SECONDARY CHARACTERS. Roots branched. Stem ſhrubby. Leaves ſimple, placed oppoſite in pairs. Flowers proceed from the angles of the leaves in ſmall cluſters. *Stipulæ* or ſubſidiary leaves ſtationed betwixt the oppoſite leaves of the plant.

** IN *Peteſia ſtipularis*, the flower-cup has five indentments. The ſubſidiary leaves in the ſame ſpecies are remarkably ſtiff and rigid.

CATESBÆA.

(Lin. Gen. Plant. 130.)

Indentments of the flower-cup four in number.
Petal very long, tubular or funnel-ſhaped.
Stamina within the chaps or jaws of the petal.
Seed-veſſel, a berry with a ſingle cavity incloſing ſeveral ſeeds.

SECONDARY CHARACTERS. Roots branched, woody. Stem ſhrubby, ſpinous; the branches ranged alternately. Leaves oppoſite, placed very cloſe. Flowers proceed ſingly from the ſide of the branches.

MITCHELLA.

(Lin. Gen. Plant. 134.)

Two flowers ſeated upon a twin ſeed-bud.
Indentments of the flower-cup four in number.
Petal tubular or funnel-ſhaped.
Seed-veſſel a twin-berry incloſing four ſeeds.

SECONDARY CHARACTERS. Roots fibrous. Stem ſhrubby. Leaves ſimple, roundiſh, placed oppoſite in pairs. Flowers terminate the branches by twos.

HEDYOTIS.

(Lin. Gen. Plant. 118.)

Flower-cup deeply divided into four.
Petal tubular or funnel-ſhaped.
Seed-veſſel, a twin-capſule which opens at top, and is divided internally into two cavities, each containing ſeveral ſeeds.

SECONDARY CHARACTERS. Roots branched, fibrous. Stem herbaceous or ſhrubby. Leaves ſimple, placed oppoſite in pairs, with footſtalks. Flowers form aggregates or cluſters either at the extremity of the branches, or at the joints of the ſtem betwixt the leaves. A *ſtipula* or ſubſidiary leaf ſtationed betwixt the footſtalks of the leaves, which they unite into a ſheath, frequently fringed, that is pervaded by the ſtem.

OLDENLANDIA.

(Lin. Gen. Plant. 154.)

Flower-cup deeply divided into four.
Petal tubular; the brim deeply cut into four ſegments.

Seed-veſſel, a twin-capſule, which ſplits betwixt the diviſions of the permanent calix, and is divided internally into two cavities, each containing ſeveral ſeeds.

SECONDARY CHARACTERS. Roots fibrous. Stem herbaceous, branched. Leaves ſimple, placed oppoſite in pairs, and attached to the branches by a ſhort footſtalk. Flowers proceed in ſmall cluſters from the angles of the leaves.

SANGUISORBA.

(Lin. Gen. Plant. 146.)

Flower-cup of two leaves.

Petal flat and wheel-ſhaped.

Seed-veſſel, a four-cornered capſule, interjected betwixt the flower-cup and petal.

SECONDARY CHARACTERS. Roots branched. Stem herbaceous, cylindrical, branched, leafy. Leaves pinnated or winged, ranged alternately, with footſtalks: the lobes or leſſer leaves ſimple, entire, ſtanding upon footſtalks. Flowers terminate the branches in ſpikes. Two entire, kidney-ſhaped *ſtipulæ* or ſubſidiary leaves ſtationed above the baſe of the footſtalks of the leaves, one on each ſide.

** IN *Sanguiſorba officinalis*, beſides the ſubſidiary leaves juſt mentioned, there are other leaves of the ſame kind which properly pertain to the lobes, and are ſeated at the baſe of their reſpective footſtalks.

GENERAL REMARK.

To this diviſion of the fourth claſs properly belong the *coffea occidentalis* and *peplis tetrandra* of our author; both which, although

although furniſhed with only four ſtamina, are made to rank with their reſpective genera, the one in the fifth claſs, the other in the ſixth.

DIVISION THE FIFTH.

Compleat flowers having one petal, a twin-fruit either covered or naked, and the ſeed-bud placed upon the receptacle or ſeat of the flower.

HOUSTONIA.

(Lin. Gen. Plant. 124.)

Indentments of the flower-cup four in number.
Petal tubular or funnel-ſhaped.
A twin-capſule, with two cells, each containing a ſingle ſeed.

OBSERVATION. In a ſpecies of this genus, the *Houſtonia purpurea* of Linnæus, the ſeed-bud is placed under the receptacle or ſeat of the flower.

SECONDARY CHARACTERS. Roots branched, fibrous. Stem herbaceous. Leaves oppoſite. Flowers terminate the ſtem, in one ſpecies ſingly, in the other in cluſters.

SCABRITA.

(Lin. Mantiſſa. Plant. 1242.)

Flower-cup tubular: its *apex* blunt, and as if ſtumped or cut off.
Petal ſalver-ſhaped.
Twin-fruit naked, compreſſed, divided above.

SECONDARY CHARACTERS. Roots branched. Stem ſhrubby; branches four-cornered, rough. Leaves oppoſite, ſtanding upon footſtalks, perfectly entire. Flowers placed on footſtalks which are four-cornered, oppoſite, and proceed ſingly from the arm-pits of the leaves.

DIVISION